MONTHLY WEATHER REVIEW.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for May, 1904, is based on data from about 3300 stations, classified as follows:

Weather Bureau stations, regular, telegraph, and mail, 167; West Indian Service, cable and mail, 4; River and Flood Service, regular 43, special river and rainfall, 190, special rainfall only, 56; voluntary observers, domestic and foreign, 2565; total Weather Bureau Service, 3025; Canadian Meteorological Service, by telegraph and mail, 20, by mail only, 13; Meteorological Service of the Azores, by cable, 2; Meteorological Office, London, by cable, 8; Mexican Telegraph Company, by cable, 3; Army Post Hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Company, 96; Hawaiian Meteorological Service, 75; Jamaica Weather Service, 130; Costa Rican Meteorological Service, 25; The New Panama Canal Company, 5; Central Meteorological Observatory of Mexico, 20 station summaries, also printed daily bulletins and charts, based on simultaneous observations at about 40 stations; Mexican Federal Telegraph Service, printed daily charts, based on about 30 stations.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. R. C. Lydecker, Territorial Meteorologist, Honolulu, Hawaii; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; Lieut. Commander H. M. Hodges, Hydrographer, United States Navy; H. Pittier, Director of the Physico-Geographic Institute, San José, Costa Rica; Commandant Francisco S. Chaves, Director of the Meteorological Service of the Azores, Ponta Delgada, St. Michaels, Azores; W. N. Shaw, Esq., Secretary, Meteorological Office, London; Rev. José Algué, S. J., Director, Philippine Weather Service; and H. H. Cousins, Chemist, in charge of the Jamaica Weather Office; Señor Enrique A. Del Monte, Director of the Meteorological Service of the Republic of Cuba.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is 157° 30′, or $10^h\ 30^m$ west of Greenwich. The Costa Rican standard meridian is that of San José, $5^h\ 36^m$ west of Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local standard is mentioned.

Barometric pressures, whether "station pressures" or "sea-level pressures," are now reduced to standard gravity, so that they express pressure in a standard system of absolute measures.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

May weather presented no unusual features on the North Atlantic Ocean, and the coasts and Great Lakes of the United States were not visited by severe storms.

Heavy rains occurred in the Middle-western States and at the close of the month the rivers of Kansas were in flood.

Drought continued in New Mexico and Arizona, and the early part of the month was very dry in Texas and the South Atlantic States.

Severe local storms were reported from Iowa and Kansas to northern Texas on the 5th, in Virginia on the 18th, and in Kansas on the 25th. During the afternoon of the 30th a well-defined tornado occurred about 12 miles west of Mobile, Ala.

NEW ENGLAND FORECAST DISTRICT.

The weather of the month was very pleasant, with more than the usual number of fair days and an abundance of sunshine. Frosts were general during the early part of the month, but caused no serious damage. No high winds occurred along the coast.—*J. W. Smith, District Forecaster.*

WEST GULF FORECAST DISTRICT.

Local thunderstorms, accompanied in some instances by high winds, occurred on several dates, and storm warnings were issued on two dates.—*I. M. Cline, District Forecaster.*

NORTH CENTRAL FORECAST DISTRICT.

The weather was without special characteristics. A few storms of moderate strength, for which warnings were issued, passed over the upper Lakes, but no wrecks or damage were reported. Frost warnings were issued on two or three occasions.—*H. J. Cox, Professor and District Forecaster.*

ROCKY MOUNTAIN FORECAST DISTRICT.

On the 1st to 3d and on the 19th and 20th heavy rains fell on the middle-eastern slope of the Rocky Mountains, and during the first period snow fell in the mountain region, the fall being very heavy in the foothill districts, notably at Cripple Creek, where the depth exceeded two feet. The rain of the 19–20th caused considerable damage in Wyoming and north-central Colorado. A heavy downpour of rain in the hills west of Cheyenne, Wyo., caused a destructive flood to sweep through a part of Cheyenne during the night of the 20th, drowning two children and damaging much property. In Colorado the damage was confined principally to the Valley of the Poudre and Greeley, where for a distance of 35 miles crops were washed out or covered with mud or débris; fences, outbuildings, bridges, etc., were washed away and considerable live stock drowned. Unfortunately for live stock and agricultural interests, the precipitation of the month did not extend far enough southward to break the drought prevailing in Arizona and New Mexico. The severe frosts that occurred in the high districts were accurately forecast, as well as the light frosts that visited the important agricultural and fruit growing dis-

tricts. The damage by frosts, if any, was small.—*F. H. Brandenburg, District Forecaster.*

SOUTH PACIFIC FORECAST DISTRICT.

The month was quite uneventful. Over the greater portion of the State no rain fell. In the extreme north and extreme south there were a few light showers.—*A. G. McAdie, Professor and District Forecaster.*

NORTH PACIFIC FORECAST DISTRICT.

The month was unusually dry with nearly normal temperatures. At Portland, Oreg., the river was above the danger line throughout the month, but as ample warning of the coming stages were issued several days in advance precautionary measures were taken to prevent avoidable losses.—*E. A. Beals, District Forecaster.*

RIVERS AND FLOODS.

The Mississippi River fell steadily after the high stages of the preceding month, remaining, however, above the danger line at New Orleans until the 23d. The Missouri also fell generally, but during the last few days of the month heavy rains over the lower watershed, including that of the Kansas River, started a rapid rise, which by the end of the month had become manifest in the Mississippi between Alton, Ill., and the mouth of the Ohio. In the lower Kansas Valley the waters of course did not reach by many feet the abnormal heights of the preceding year. Nevertheless, considerable damage was done between Topeka and Kansas City, principally by the flooding of lowlands. In the vicinity of Kansas City the damage was much greater. Several temporary pile bridges over the Kansas River were swept away, and the bottoms were covered with water. Many of the inhabitants were driven from their homes. Business was suspended in some localities, and railroad service badly demoralized.

During the first decade of the month the high water in the Mississippi River caused considerable damage in the vicinity of Cairo. On the Illinois side of the river hundreds of acres of wheat were submerged and destroyed, while on the Missouri side the loss to the St. Louis and San Francisco Railroad between St. Louis and Poplar Bluff, Mo., was about $100,000.

The following report on the spring flood in the Memphis district, where the highest proportionate stages were reached, was prepared by Mr. S. C. Emery, Official in Charge of the United States Weather Bureau office, Memphis, Tenn. This report will be found to be very interesting. It apparently decides a much mooted question that arose during the close of the flood of 1903, as to the effect of the railroad embankments opposite in ponding the water above. It now seems that the embankments were not seriously at fault, the surplus water having come through a 10-mile gap near the upper end of Reelfoot Lake district. This water left the main stream in the vicinity of Hickman, Ky., and reentered it in the neighborhood of Fulton, Tenn. Mr. Emery also remarks that for the first time the St. Francis levee successfully resisted a severe flood.

Moderately low river stages prevailed in the Memphis district throughout the winter months, and until March 1 the water was considerably below normal. As this was later than the usual time for the formation of floods, it was generally thought that no serious rise was likely to occur this year, and farmers and levee contractors began the season's work. During the first ten days in March two sharp swells started in the upper Ohio, the crests of which soon merged into one and reached Cairo during March 17, with a stage of 36.2 feet. On March 11, twelve days previous to the arrival of the crest of the rise at Memphis, announcement was issued from the Memphis office that the maximum stages in that district would be as follows: New Madrid, 29 feet; Memphis, 25 feet. On March 16 the estimate for Memphis was increased to 26.5 feet, and a stage of between 35 and 36 feet predicted for Helena, Ark. The repeated assertion that the water would not exceed the estimates given was generally accepted, and work along the river continued without interruption. The greatest variation from the predicted stages and those that actually occurred was 0.3 of a foot, while the average time given was eight days. The maximum stages on this rise were as follows: New Madrid, 29.1; Memphis, 26.8; and Helena, 35.1 feet. After the passing of this wave, the river fell slowly for a few days, the total fall being only two feet, when the decline was arrested by a second swell, which was first felt at Cairo on March 25. This rise was caused by general and heavy rains throughout Missouri, Illinois, Indiana, and Kentucky, swelling the Ohio at a rapid rate, and many of its tributaries to unprecedented stages. The Mississippi above Cairo also rose rapidly for several days, so that by March 30 it was apparent that a flood of considerable magnitude was on its way to this section.

On March 30 warning bulletins were mailed to every post office in the district and to all interests likely to be affected to prepare for a stage exceeding 36 feet on the Memphis gage. On the following day a second warning was issued to the effect that the stage would exceed 37 feet at Memphis, and reach at least 47 feet at Helena. The prediction was also made that New Madrid would have a stage of at least 38 feet. The people were warned that the stages indicated would severely tax the levees in the St. Francis district, and to be prepared for possible breaks. On April 6 the river at New Madrid, after rising slowly during the four preceding days, came to a stand at a stage of 38.6 feet. From the fact that the crest had passed New Madrid and the rise at Memphis from April 1 to 6 was only moderate and slowly decreasing, doubts were freely expressed regarding the probability of the Memphis stage reaching the 37-foot mark as predicted. On the latter date, however, the rise suddenly and unexpectedly increased to one foot or more per day, and continued at that rate for three days, carrying the water about one and one half feet above the highest estimate heretofore made. This unlooked for rise is now known to have been caused by the ponding of water in the Reelfoot country, which lies immediately south of Hickman, Ky.

This water entered that basin through a 10-mile gap near the upper end of the Reelfoot Lake district, and, after making its way slowly through the wooded lowlands, where it increased in volume, again entered the main stream near Fulton and Fort Pillow, Tenn. In that way the water passed around New Madrid and caused the deceptive changes recorded by that and other gages as far south as Osceola, Ark. This accumulated water then poured out upon the top of the flood, and raised the stage at Fulton about 3 feet in as many days. The ponding of water in the Reelfoot basin is due in a great measure to the changed conditions brought about through the extension of the levee system, which has raised the flood level to a height heretofore unknown, causing a deflection of the water into new channels. From an examination of the records obtained during the flood of 1903, it is seen that after the water had reached the highest stage at New Madrid, the Fulton gage indicated the same sudden increase noted this year, and for about four days the river rose over 1 foot a day. This information is important, as it clearly indicates that the remarkable rise that occurred at Memphis during the three days next preceding the arrival of the crest at that place in both 1903 and 1904 was probably due to the outpouring of water from the Reelfoot basin, and not, as was formerly supposed, to an engorgement produced by the railroad embankments in front of Memphis on Hopefield Point. These embankments may have had some effect on the stage at Memphis, but the main cause must be attributed to deflection of the water into the Tennessee basin, which has the same effect as the St. Francis basin formerly had on the Helena gage when the water was permitted to overflow that section.

The wave crest reached Memphis April 11 with a stage of 39 feet, and Helena on the 15th, the stage at that place being 47.7 feet. Warnings for the above stages were given two days in advance at Memphis and five days at Helena. The water remained above the danger line in this district, as follows: New Madrid 20, Memphis 19, and Helena 22 days. During the week preceding and the one following the arrival of the crest, all of the levees fronting the St. Francis basin were in a very critical condition, and had all the water they could hold. By prompt action on the part of the engineers and the employment of several hundred men the weak places were repaired, and a topping of sand bags placed wherever the height appeared insufficient. Notwithstanding the extreme height of the water, the continued rains, and other unfavorable weather conditions, the levees were held intact throughout the entire system, and marked the first successful resistance to the encroachment of the water on the St. Francis basin.

Compared to the flood of 1903, the stage at Cairo was 1.5 feet lower, New Madrid 0.9 of a foot lower, Memphis 1.1 feet lower, and Helena 2.3 feet lower. All of the island plantations and the lowlands in Arkansas that lie outside the levee were entirely covered, and the extreme southern portion of the St. Francis basin in the counties of Lee and Phillips, where no levee exists, was also flooded as usual. On the Tennessee side a large territory was inundated, causing considerable damage and great inconvenience to the dwellers in that section. In and about Memphis the flood was about as severe as in 1903, but as the people were better prepared, the damage was slight.

During the progress of the flood the Weather Bureau office was hourly besieged by anxious inquirers from far and near, while the telephone calls were more frequent than ever before known. The daily stages at all important points, and the daily forecasts were sent by telephone and telegraph to a large number of places for distribution to the adjacent

country. Maps and river bulletins were furnished all outgoing steamers for distribution along the river, and every possible means was employed to obtain and distribute information. In this way the people throughout the threatened district were at all times in close touch with this Bureau, whose work in this connection has been highly commended by many of those benefited thereby. It is worthy of note that the usual excitement attendant upon severe floods was noticeably absent this year. This was largely due to the conservative tone of the reports issued, and to the fact that newspapers, as a rule, refrained from publishing alarming and exaggerated accounts of the flood. This was very beneficial and prevented many people from incurring the unnecessary expense of moving property and families, and enabled planters to retain their negro workmen, who would have otherwise fled.

The third important rise of the season began about May 1, reaching its maximum at Madrid on the 7th, Memphis on the 9th, and Helena on the 11th. At Helena, only, did the water reach the danger line, Memphis being 0.8 of a foot, and New Madrid 0.5 of a foot below that mark. The crest stages on this rise were accurately predicted from six to eight days in advance, the stages forecast in no case showing a variation of over 0.3 of a foot. The following are the maximum stages recorded during the May rise: New Madrid, 33.5; Memphis, 32.2; and Helena, 42.0 feet. Owing to the lateness of the season and the damaging effect that an overflow would have at this time, especially upon growing crops, those having farming interests at stake were very anxious as to the outcome of the rise. However, as forecast, it did not cause the river to overflow its banks to any great extent, and no material damage resulted.

There was also a flood in the Colorado River of Texas during the early days of the month, due to heavy general rains. Warnings were issued on the 4th for danger-line stages below Austin, and they were fully verified. In the Brazos River the stages, while quite high, did not reach dangerous proportions.

There is nothing further of special interest to be mentioned, except the somewhat remarkable fact that ice in considerable quantities, the last remnants of the great gorge of the winter of 1903–4, was observed along the Susquehanna River between Harrisburg and York Haven, Pa., after the middle of the month.

The highest and lowest water, mean stage, and monthly range at 188 river stations are given in Table VII. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, District Forecaster.*

CLIMATE AND CROP SERVICE.

By Mr. JAMES BERRY, Chief of Climate and Crop Service Divison.

The following summaries relating to the general weather and crop conditions during May are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau; they are based upon voluntary reports from meteorological observers and crop correspondents, of whom there are about 3000 and 14,000, respectively:

Alabama.—Generally too dry and cool for growth; warm weather and fairly general rains during the last week beneficial, though drought continued in southeastern counties. Cotton stands generally inferior; plants small, but improving at close of month, when the crop was mostly chopped. Corn did fairly well; some upland corn laid by, some in tassel during last week, when oats and wheat were being cut; oats light yield; wheat fair to good; minor crops fair.—*F. P. Chaffee.*

Arizona.—Moderate temperatures prevailed during May. The precipitation was above normal, most of it occurring on the 10th and 11th. Crops in the lower Colorado Valley made fine growth. Local showers early in the month revived vegetation elsewhere, but the dry weather which followed largely overcame the beneficial effect of those showers and crops were again in poor condition. The ranges, which were improved by the rain, again deteriorated. Stock generally suffered greatly.—*M. E. Blystone.*

Arkansas.—Cool, with less than the usual amount of rain. Cotton planting completed; early planted fair stand; late planted fair to good; plant small but healthy; chopping well advanced. Corn planting completed; stand fair to good; cultivation general; being laid by in southern portion at close of month; stalk small but healthy. Oats and wheat promising; heading in southern portion at close of month. An average crop of apples and peaches of excellent quality indicated.—*Edward B. Richards.*

California.—Dry northerly winds during the month caused considerable damage to grain and vegetables, and high winds on the 24th and 25th seriously injured cherries and other deciduous fruits in some sections. The grain and fruit crops promise to fall below early estimates in nearly all parts of the State. Barley harvest and haying are progressing. The hay crop is large and of excellent quality. Deciduous fruits are ripening and citrus fruits are in good condition.—*G. H. Willson.*

Colorado.—Month favorable. Planting of corn and early potatoes was finished. Potatoes were a good stand, but the weather was too cool and wet for corn. Fall grain, alfalfa, and range grass improved steadily. Gardens were good and the prospect for fruit was fine, only slight damage resulting from frost. Beet thinning, melon planting, and tomato setting were under way. Floods caused considerable damage in the Poudre Valley during night of 20th.—*F. H. Brandenburg.*

Florida.—The month was dry and mostly cool, conditions favorable for farm work, but not conducive to the germination of seed and the growth of plants. Early planted cotton advanced very well and at the close of the month was fruiting freely; late planting was backward; poor stands were general. Corn suffered for rain and the crop from the early planting will be short. Citrus fruits dropped freely as result of drought. Pineapples were cut off very much. Peaches were plentiful, but small.—*A. J. Mitchell.*

Georgia.—The first half of the month was moderately cool, the latter part abnormally warm. This was the eighth consecutive month with precipitation below average. Crop conditions were serious, drought prevailed until the very last of the month, when beneficial showers occurred and relieved a situation that was viewed with grave apprehension. Cotton made slow growth. Spring oats were almost a failure. Corn was abnormally small. Fruit prospects were bright.—*J. B. Marbury.*

Idaho.—The driest May on record; irrigated crops made satisfactory progress, as a rule, but some unirrigated hay and grain and late sown sugar beets suffered from drought. There was some damage to fruit by frost, but not sufficient to affect the general yield materially. Range grass made excellent growth and stock made good gains. Streams remained high from melting snow.—*Edward L. Wells.*

Illinois.—The month opened with unseasonable weather, but quite favorable conditions followed, beginning during the first decade and continuing for the most part during the remainder of the month. Considerable advance was made in corn planting; about one-half the crop was in the ground by the 15th, and by the end of the month corn was mostly all planted in the northern portion, and the work was well advanced in the southern. Oats, wheat, and grasses were generally promising.—*Wm. G. Burns.*

Indiana.—Farming operations continued behind throughout the month. On account of poor crop prospects much wheat was plowed up; the remainder promised light crop. Sowing oats was finished during first decade, prospects favorable for good crop. Corn planting began about May 10, and was unfinished at end of month; much replanting necessary on account of cutworms. Old clover thin and weedy, other hay crops promising. Peaches promised light crop; other fruits fair to excellent prospects.—*W. T. Blythe.*

Iowa.—May was about normal as to temperature and rainfall, with generally favorable conditions for planting, germination of seed, and cultivation. Delay in planting was caused in limited areas by excess of rainfall on previously saturated soil. As a whole the month was favorable for field operations, germination of seed, and normal growth of grasses, cereals, potatoes, and garden truck. Fruits were more promising than in recent years.—*John R. Sage.*

Kansas.—Wheat continued in good condition, had headed in the southern counties, and was heading in the central. Spring wheat made good growth. The wet weather retarded corn planting and the cool nights retarded its growth, yet by the end of the month the corn was coming up in the northern counties and was being cultivated in the southern. Oats, barley, and grass made good progress. Alfalfa was ready to cut in several counties by close of month.—*T. B. Jennings.*

Kentucky.—Moderate warmth during the first week was followed by cool weather until about the 20th, checking the growth of crops. The temperature rose afterwards and warm weather continued until the end of the month. The rainfall was a little less than normal and irregularly distributed. Wheat improved decidedly during the month. Corn advanced well during the last ten days. The month closed with tobacco setting in progress. Crops generally in good condition.—*H. B. Hersey.*

Louisiana.—Cotton planting was completed under favorable conditions; prevailing low temperatures caused poor stands in some localities and retarded growth, but warmer weather at close of month proved more favorable; the plant was small but healthy. Corn grew slowly; the crop was well cultivated. Cane grew slowly but was generally promising. Irrigated rice did well; the rainfall was not sufficient for Providence rice. Truck gardens gave good yields.—*I. M. Cline.*

Maryland and Delaware.—Temperature and sunshine were above nor-

mal. Precipitation was below normal and unevenly distributed, but ample until last decade, when rain was much needed. Wheat made decided improvement and reached almost average condition. Oats and rye excellent. Corn germinated poorly and stands were unsatisfactory. Pastures were short until the last decade. Enough fruit set to give fair returns. Strawberry crop reduced by drought. Tobacco setting delayed by dry weather; plants were plentiful and thrifty. Potatoes and peas made excellent progress.—*Oliver L. Fassig.*

Michigan.—Most of May was too cool and dry in the principal agricultural counties for normal germination and growth. Field work progressed favorably. Wheat, rye, meadows, and pastures made fair growth, but the general condition of wheat at the close of the month was very poor. Oats, peas, sugar beets, and early potatoes germinated nicely, but slowly. Corn planting was general during the last decade, but much replanting was necessary on account of the unusually poor seed. All fruits, except peaches, continued promising.—*C. F. Schneider.*

Minnesota.—Showers from 5th to 13th and from 21st to 26th were beneficial except in north, where first rainy period delayed seeding of wheat and oats. Seeding of wheat, oats, barley, and flax and planting of corn and potatoes were finished by the 31st, except scattered areas of corn, barley, flax, and potatoes. Pastures, haylands, and fruit were promising. Temperatures were low for corn, but favorable for wheat, oats, and barley.—*T. S. Outram.*

Mississippi.—On account of unseasonably cool weather crops were backward, but unusually well cultivated. Drought injured stands of corn and cotton in some northern counties, and lice damaged cotton in a few southeastern counties; elsewhere stands were generally good. Chopping cotton and laying by corn were about completed. Oats were being harvested, with fair to good yields. Sugar cane, minor crops, and gardens generally did well. Early peaches were yielding well. Vegetable shipments were heavy.—*W. S. Belden.*

Missouri.—The month was generally unfavorable for farm work and plant growth; the temperature was only slightly below normal, but sunshine was needed, as cloudy conditions prevailed. Rains were general and heavy. Farm work was much retarded and for several days completely stopped. Corn was about two-thirds planted; the most favorable progress was noted in the southern sections. Wheat continued in fair condition; oats improved during the latter part of the month; peaches fair; apples poor.—*George Reeder.*

Montana.—The temperature conditions were generally favorable for stock and farm work, there having been no severe cold changes. Precipitation decidedly below normal but uniformly distributed throughout the month. Moisture sufficient in most sections for range and crops; irrigation unnecessary till latter part. Plowing and seeding of oats and spring wheat nearly finished by 15th, potatoes mostly planted by the close. Sheep and cattle improved steadily, and the month was unusually favorable for lambing. Fruit not materially damaged by frost.—*R. F. Young.*

Nebraska.—Generous and well distributed showers supplied ample moisture for crops without interfering seriously with farm work. Corn generally was planted before the 20th. Low temperature was unfavorable for germination and growth. Oats came up slowly with rather thin stand. Early planted corn came up poorly, and some replanting was necessary. Winter wheat, grass, and alfalfa made good growth. Plum, peach, and cherry trees blossomed very full, and promised large crop. Apple blossoms were less abundant.—*G. A. Loveland.*

Nevada.—The temperature was about normal, and the precipitation slightly deficient. The weather of the month was quite favorable to farming interests in all parts of the State. There were a few cold nights and frosty mornings the last week, which checked growth to some extent. Range grass was much better than usual and stock of all kinds did well. Alfalfa, grain, and early garden truck made good progress. Irrigation water was plentiful in all districts.—*J. H. Smith.*

New England.—Excepting May, 1889, with a mean temperature of 59.2°, the month was the warmest of its name in the history of the New England Climate and Crop service. The weather was generally favorable to farm operations and to crops, and especially to grass and winter grain. Fruit trees and berries bloomed very full, fruit was setting well and promised good crops. The season at the close of the month was near the average.—*J. W. Smith.*

New Jersey.—The weather was generally favorable for truck farming, except in the extreme southern portion where a scarcity of rainfall retarded growth and the setting out of sweet potatoes and other truck plants. Corn was all planted; much replanting was necessary, owing to failure of seed to germinate. Orchard fruit trees, except peaches, had a fairly good set of fruit. A very large acreage of late round potatoes were planted.—*Edward W. McGann.*

New Mexico.—Drought at beginning of the month partially relieved by showers in second decade, heaviest in northeastern counties; about one-half of the Territory benefited, southwestern districts remained dry and windy. Fair flow for irrigation in upper Rio Grande, Gila, and lower Pecos, but generally water very scarce and farm work at standstill; ranges dormant; stock losses great from lack of food and water; increase of lambs small. Light yields of fruits indicated, owing to frosts and drought.—*Charles E. Linney.*

New York.—First half of month dry and favorable for work, latter half too wet. Farm operations very backward; planting corn and potatoes not finished. Wheat and rye poor; pastures and meadows excellent; small acreage of tobacco; hops doing well; considerable progress made in sowing sugar beets; apples and berries promising; peaches will be extremely light; pears damaged by severe winter; grapes generally promising, but some poor setting reported; fruit damaged by hail on the 25th and 26th.—*R. G. Allen.*

North Carolina.—May was too cool for rapid germination or growth of crops, and showers, though frequent, were light, and the soil dried out rapidly, so that drought prevailed in several central counties. The latter part of the month was warmer and all crops started into rapid growth. Cotton and corn were nearly all planted and fairly good stands secured. Much tobacco was transplanted. Truck crops and gardens did well. Peaches promised a fairly good yield.—*C. F. von Herrmann.*

North Dakota.—The weather was generally quite favorable for farm work. Seeding was frequently interrupted by rain and frosts during the fore part of the month, but the latter part was generally warm and pleasant, and the close found wheat seeding practically finished, while seeding of oats, rye, flax, and barley was well advanced in all sections. Corn planting was in progress in most sections at the end of the month, and grass was abundant and growing rapidly.—*B. H. Bronson.*

Ohio.—The temperature was slightly below normal for the entire State; the highest occurred on the 25th, the lowest on the 11th and 16th. Precipitation was slightly above normal for the State, except a slight deficiency in the middle section. A trace of snow fell on the 15th. Frost on the 16th damaged berries, tender fruits, and garden truck. Much wheat was plowed up, but that remaining improved. Corn planting was slow. Potatoes promising. Tobacco plants plentiful. Oats did well.—*J. Warren Smith.*

Oklahoma and Indian Territories.—May was marked by almost daily precipitation, at times heavy and torrential in character. Wheat and oats were greatly benefited by rains. Cotton and corn were planted by the close of the month, and up to good stand. Kafir and broom corn, millet, castor beans, milo maize, and sweet potatoes were planted, and coming up to good stands. Irish potatoes were being gathered with good yields. Fruit did fairly well. Hail caused some damage to crops.—*C. M. Strong.*

Oregon.—Month deficient in precipitation, but timely showers were well distributed. Nights too cool for rapid growth. Several frosts with but little damage. Fall wheat thrifty and heading well. Early spring grains doing well; late crops made slow growth. Alfalfa harvest begun with satisfactory yields. Pastures excellent. Cattle in fine condition. Lambing season finished with but small loss. Wool clip average. Hops very promising. Fruit prospects good, except Italian prunes, which were lightest in years.—*Edward A. Beals.*

Pennsylvania.—Nearly seasonable weather conditions prevailed during May, but the cold, saturated soil caused much of the early seeded corn to rot before germinating, and much replanting was necessary. Grain that survived the winter made fair progress. At the close of the month oats and grass were well advanced. Tobacco and garden truck were backward, but thrifty. With the exception of peaches, most fruits bloomed profusely.—*T. F. Townsend.*

Porto Rico.—Rainfall generally light until the last week, when heavy showers occurred. The land became hard and dry in places, delaying planting of cane and small crops. Sugar making was finished at some haciendas early in the month, and by the close most of the cane had been ground; the yield was generally good. Young canes were in excellent condition. Many plots of corn, beans, and other crops were planted, and corn and beans were harvested. Early planted cotton did well. The outlook for the next coffee crop did not improve. Mangoes and pineapples were marketed. Stock continued in good condition.—*E. C. Thompson.*

South Carolina.—The nights were unusually cool, which retarded germination and growth of vegetation during the first twenty days. Drought prevailed generally, but was partially relieved by copious showers on the last three days. The weather was favorable for cultivation of field crops, and for finishing planting operations. Oat harvest was begun about the 15th. Corn and cotton remained small, and stands were not satisfactory, owing principally to the dry weather, which also reduced the yields of truck along the coast.—*J. W. Bauer.*

South Dakota.—Conditions were generally favorable for field work and for the germination and growth of spring wheat, oats, barley, spelt, and spring rye, seeding of which was practically completed by the 20th. Corn planting was nearly completed, but poor seed necessitated some replanting, and cool, damp soil retarded germination and growth. Potato planting and the sowing of flax and millet progressed favorably. Grass was backward, but by the 20th afforded good pasturage.—*S. W. Glenn.*

Tennessee.—Favorable conditions until the 14th were followed by a week of dry, cool weather, with light frosts, which injured young crops, especially cotton. The last week was warmer, with fine rains on the 29th and 30th. At the close of the month cotton was small and making slow progress; corn, potatoes, gardens, spring oats, and meadows were doing fairly well; tobacco setting was in progress; wheat was heading well; fruit prospects were fairly good.—*H. C. Bate.*

Texas.—The precipitation conditions of the month were generally favorable. The first and second decades were too cool for rapid growth, but favorable temperature conditions prevailed during the last decade. Cotton planting was completed in the eastern half of the State during the

SUMMARY OF TEMPERATURE AND PRECIPITATION BY SECTIONS, MAY, 1904.

In the following table are given, for the various sections of the Climate and Crop Service of the Weather Bureau, the average temperature and rainfall, the stations reporting the highest and lowest temperatures with dates of occurrence, the stations reporting greatest and least monthly precipitation, and other data, as indicated by the several headings.

The mean temperatures for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperature and precipitation are based only on records from stations that have ten or more years of observation. Of course the number of such records is smaller than the total number of stations.

Section.	Temperature—in degrees Fahrenheit.							Precipitation—in inches and hundredths.					
	Section average.	Departure from the normal.	Monthly extremes.					Section average.	Departure from the normal.	Greatest monthly.		Least monthly.	
			Station.	Highest.	Date.	Station.	Lowest. Date.			Station.	Amount.	Station.	Amount.
Alabama	69.6	— 1.8	Dothan	99	28	Onconto	37 15	2.98	−0.56	Camp Hill	5.50	Ozark	0.66
Arizona	70.0	— 0.2	Fort Grant	107	14	Flagstaff	20 2	0.50	+0.33	Parker	2.00	7 stations	0.00
			Aztec	107	26								
Arkansas	67.1	— 2.3	Lonoke	98	23	Dodd City	31 12	3.39	−1.34	Eureka Springs	6.08	Winchester	1.39
California	64.9	+ 2.4	Indio	113	8	Bodie	15 1	0.22	−0.89	Crescent City	1.96	54 stations	0.00
Colorado	51.6	— 1.6	Delta	97	19	Clear View	6 3	2.75	−0.87	Alford	8.18	Conejos	0.00
Florida	74.9	— 2.7	Lake City	100	27	Marianna	44 11	2.51	−1.01	Key West	13.01	Lake City	0.30
			Tarpon Springs	100	30	Molino	44 11						
Georgia	70.2	— 1.2	Blakeley, Fitzgerald	102	28	Clayton	38 1	2.23	−0.85	Clayton	4.44	Fitzgerald	0.64
Idaho	53.5	.....	Garnett, Payette	90	21	Paris	12 8	0.70	.....	Forney	1.75	Blackfoot	T.
Illinois	62.2	— 0.9	Peoria	93	21	Lanark	27 15	3.43	−0.64	Olney	6.56	Chicago	1.54
Indiana	62.0	— 0.5	Rome	95	25	5 stations	29 16	3.35	−0.63	Farmersburg	5.87	Paoli	1.41
Iowa	59.6	— 0.8	Ridgeway	93	22	Charles City	27 15	3.78	−0.35	Onawa	8.15	Clearlake	1.50
			Englewood	94	23								
Kansas	62.4	— 2.5	Achilles, Norton	94	24	Hanover	21 14	5.81	+1.86	Olathe	11.71	Wallace	1.28
			Garden City, Viroqua	94	31								
Kentucky	65.0	— 0.9	Shelby City	98	25	Eubank	33 15	3.05	−0.65	Shelby City	6.24	Paducah	1.21
						Williamsburg	33 15						
Louisiana	72.0	— 1.9	Reserve	97	28	Liberty Hill	43 15	3.20	+0.02	Ruston	6.55	Houma	1.01
						Plain Dealing	43 15						
						Mansfield	43 15						
						Robelin	43 1						
Maryland and Delaware	64.2	+ 1.2	Boettcherville, Md	102	25	Oakland, Md	26 12	2.54	−1.41	Clear Spring	4.20	Millsboro, Del	1.33
Michigan	55.0	+ 0.8	5 stations	90	25	Mancelona	12 11	3.87	+0.10	Petosky	11.09	South Haven	1.05
Minnesota	55.4	— 0.6	Milan, Montevideo	90	22	Pokegama Falls	19 15	2.43	−0.75	Saint Charles	5.44	Leech Lake Dam	0.76
Mississippi	70.1	— 2.3	Okolona	101	23	4 stations	40 14, 16	2.80	−0.50	Leakesville	5.59	Pontotoc	0.42
Missouri	63.1	— 1.9	Jackson	95	24	Ironton	32 15	5.03	+0.22	Kansas City	10.70	Doniphan	1.45
Montana	51.6	— 1.0	Lodgegrass	95	28	Wolsey	18 8	1.44	−0.76	Red Lodge	4.29	Chester	0.16
						St. Peters	18 25						
Nebraska	59.2	— 0.6	Bartley	100	24	Agate	21 9	3.68	+0.02	Blair	7.87	Central City	1.24
Nevada	54.0	+ 1.2	Martins Ranch	98	23	Eureka	10 23	0.85	−0.16	Wood	3.02	3 stations	0.00
New England*	58.7	+ 3.4	Nashua, N. H	91	26	Fort Fairfield, Me	20 1	3.53	−0.27	Thomaston, Me	7.00	Norfolk, Mass	1.80
			Westboro, Mass	91	26								
New Jersey	62.8	+ 2.4	Indian Mills	97	25	Charlottsburg	31 3	2.60	−1.65	Asbury Park	6.69	Atlantic City	1.01
New Mexico	61.2	+ 0.1	Alamogordo	99	29	Winsors	17 9	0.73	−0.39	Eagle Rock Ranch	2.70	Deming	0.00
			Carlsbad	99	7								
New York	59.2	+ 3.2	Rome	95	25	Perry City	22 11	3.28	+0.07	Adams Center	6.83	Richmondville	1.10
North Carolina	66.3	— 0.8	Henrietta, Moncure	95	24	Linville	28 16	3.43	−0.70	Jefferson	10.05	Currituck	0.94
			Monroe	95	24								
North Dakota	54.2	+ 0.8	Wishek	93	4	Larimore	20 14	1.76	−0.57	Walhalla	3.42	Medora	0.11
Ohio	60.7	— 0.5	Hanging Rock	95	25	Hedges	27 16	3.79	+0.16	Garrettsville	7.62	New Bremen	1.55
			Waverly	95	25	New Bremen	27 16						
Oklahoma and Indian Territories.	67.4	— 1.6	Eldorado, Okla	100	30	Taloga, Okla	36 14	4.94	+0.23	Okmulgee, Ind T	10.66	Kenton, Okla	0.99
Oregon	56.0	+ 0.8	Riverside	98	21	Pine, Riverside	22 5	0.91	−1.47	McKenzie Bridge	2.64	Beulah	0.00
Pennsylvania	61.6	+ 2.3	Johnstown	94	25	Smethport	21 12	3.78	−0.52	Warren	7.50	Gettysburg	2.07
			Lock Haven	94	25								
			Mauch Chunk	94	25								
Porto Rico	76.4	.....	Manati	97	23	Carozal	51 11	4.77	.....	Les Marias	15.71	Barros	1.04
South Carolina	70.6	— 1.4	Gaffney	99	24	Liberty	38 17	2.04	−1.34	Walhalla	4.67	Sumter	0.23
South Dakota	57.5	0.0	Elkpoint	92	22	Ramsey	22 14	2.46	−0.23	Fort Meade	4.52	Hotch City	0.41
Tennessee	65.8	— 1.3	Hohenwald	97	25	Hohenwald	30 15, 16	3.81	+0.11	Grace	6.90	Rogersville	2.13
						Rugby	30 15						
Texas	72.5	— 1.4	Cotulla	103	31	Tulia	37 9	4.56	+1.26	Austin	11.37	El Paso	0.06
Utah	56.2	— 0.8	Rockville	100	17	Emery	15 1	1.71	+0.75	Tooele	3.84	Terrace	0.07
Virginia	64.0	— 0.8	Columbia	95	28	Bigstone Gap	30 17	3.10	−1.03	Hot Springs	5.80	Petersburg	1.24
			Woodstock	95	24								
Washington	54.4	— 0.8	Kennewick	94	21	Waterville	22 11	0.76	−1.53	Clearwater	4.43	2 stations	0.00
West Virginia	61.8	— 0.2	Ryan	98	25	Powellton	25 16	3.55	−1.06	Leonard	5.80	Creston	1.54
Wisconsin	56.0	— 0.4	Koepenick	90	3	Spooner	22 15	4.73	+0.17	Antigo	8.60	Ashland	1.09
			Prairie du Chien	90	22								
Wyoming	48.6	— 1.2	Embar	91	24	Grand Canyon (Yellowstone Park)	9 8	2.55	+1.35	Cheyenne	6.66	Basin	0.58

* Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut.

early part of the month and progressed rapidly in the western half after the rains of the first week; good stands were generally secured; growth was very slow during the first and second decades on account of the cool weather. In the southern portion early planted cotton was putting on squares the latter half of the month. Boll weevils increased rapidly in the southwestern and central portions the last two weeks, but the cotton crop was not sufficiently matured for them to cause damage. Conditions were very favorable for corn. At the close of month it was in tassel in the middle and northern portions and in roasting ears in the southern portion. Rice and sugar cane did well. Fall wheat and oats were being harvested the latter part of the month.—*L. H. Murdoch.*

Utah.—First decade was cold and rainy, stopping practically all work and growth, but warm, clear weather followed and all vegetation made excellent showing. Frost in scattered localities did slight damage. Gardens were yielding well. Beets were thrifty and thinning was progressing. Fruit was well advanced and cherries were ripening in the southern counties. The range was holding out well and stock was in good condition. Sheep shearing was completed and the wool clip was generally good. Irrigation water was plentiful.—*R. J. Hyatt.*

Virginia.—The weather during the first and second decades of May was rather too cool for good crop growth, but during the last decade the conditions of temperature and moisture were seasonable and vegetation advanced rapidly. Winter wheat and spring oats improved materially. Very little tobacco was transplanted. Corn, though small, passed through the month satisfactorily, and at its close was vigorous and growing well. Truck crops were freely marketed. The prospect for fruit, except apples, was poor.—*Edward A. Evans.*

Washington.—Although the month was exceptionally dry the crops did not suffer, because the soil was already well saturated. During the month vegetation recovered, in a great measure, from its backward state. Winter wheat made fine progress and was headed out at the end of the month. Spring wheat, barley, and oats grew slowly and needed rain and

warmer weather. Spring wheat seeding and potato planting were finished by the 15th.—*G. N. Salisbury.*

West Virginia.—The weather during the greater part of May was very favorable for crop growth and farm work. Plowing and planting progressed rapidly and were about completed. Oats, meadows, and pastures grew rapidly and were looking well. Wheat and rye improved greatly, but the prospect was for light yields. Potatoes made good growth, and stock was in fine condition. The prospect for apples, peaches, pears, and cherries was less encouraging, as there was considerable dropping.—*E. C. Vose.*

Wisconsin.—The progress of crops for the month, as a whole, was generally satisfactory. Winter wheat and rye and spring grains, although retarded by the cold, wet weather during the early part of the month, made substantial and healthy growth. Corn planting was delayed by the wet weather, and there was much complaint of poor germination. Meadows and pastures made satisfactory growth. Strawberries and cranberries were very promising; apples good; blackberries and raspberries promised light crops.—*W. M. Wilson.*

Wyoming.—The unusually heavy precipitation was extremely favorable for the ranges, and at the close of the month they were in excellent condition. The cool, wet weather delayed seeding somewhat and prevented rapid growth of gardens, grain, and alfalfa. Stock made good gains, but some lambs and calves were lost during the storms. Streams were high and prospects excellent for a good supply of water for irrigation.—*W. S. Palmer.*

SPECIAL ARTICLES.

STUDIES ON THE CIRCULATION OF THE ATMOSPHERES OF THE SUN AND OF THE EARTH.

VI.—THE CIRCULATION IN CYCLONES AND ANTICYCLONES, WITH PRECEPTS FOR FORECASTING BY AUXILIARY CHARTS ON THE 3500-FOOT AND THE 10,000-FOOT PLANES.

By Prof. FRANK H. BIGELOW.

In my paper on "The mechanism of countercurrents of different temperatures in cyclones and anticyclones," MONTHLY WEATHER REVIEW, February, 1903, some account was given of the construction of the auxiliary charts of barometric pressures for the United States on the 3500-foot and the 10,000-foot planes, to correspond with the daily weather map on the sea-level plane. These new charts have been prepared daily since December 1, 1902, and they have been carefully studied from that time with two purposes in view, the results of the examination being briefly stated in this paper, while the more detailed explanation will appear in Volume II of the Annual Report of the Chief of the Weather Bureau for 1903–4. The first purpose concerns the information they have given as to the actual circulation in the strata above the surface, and its relation to several theories which have been advanced to account for these local circulations, and the second has regard to the derivation of precepts useful in forecasting the weather. It is quite impossible, I presume, to convey to one who has not had an opportunity to see these upper-level charts any adequate impression of their significance to modern meteorology, or of the transformations which take place in the structure of the three systems of isobars, as a cyclone passes over the United States. They must be taken together for the best results, and the study of their *mutual* configurations and variations affords us an insight into the true cause of storm formation, which is decisive as to their nature, and is of especial interest to the intelligent forecaster.

THE STRUCTURE OF THE ISOBARS AT DIFFERENT LEVELS.

In the MONTHLY WEATHER REVIEW for January and February, 1903, several examples were given of the configuration of the isobars in cyclones on the three reference planes, and also of their resolution into two components, namely, the normal isobars of the month and the abnormal or disturbance isobars, which, when added to the normal isobars, produce the observed isobars of the date. The normal monthly isobars were taken from the Barometry Report, 1900–1901, and the separation of the two systems was made by means of a graphical construction. Our purpose was to separate the strictly local disturbance circulation from the general circulation, so far as the isobars are concerned, and to compare this component of the pressure with the wind vectors which had been derived from the cloud observations of 1896–97, a summary of which was given in the MONTHLY WEATHER REVIEW for March, 1902. To illustrate this process, Charts XII and XIII for February 3, 1903, are introduced.

Chart XII, fig. 63, gives the sea-level isobars as on the weather map for February 3, 1903; fig. 64 gives in black the isobars of the same date on the 3500-foot plane, and in red those on the 10,000-foot plane. The components are given on Chart XIII, where the black lines on fig. 65 give the normal system for February on the 3500-foot plane undisturbed by cyclonic action, and the red lines the abnormal system, which, when added to the normal, produces the black lines of fig. 64. The black lines in fig. 66 give the normal and the red lines the abnormal system on the 10,000-foot plane. Since the disturbance on the sea-level plane is not much affected by the normal system, the resolution into components is omitted. It follows that we shall properly compare together fig. 63 and the abnormal systems, or red lines, on figs. 65 and 66 when discussing the theory of cyclonic gyrations. In the course of the year numerous modifications of the fundamental type occur, but in all cases it is not difficult to detect what this modification is and to be certain that we are dealing with one simple, natural structure to which every theory must conform to become acceptable.

In order that we may concentrate attention more closely upon the primary structure, which suffers numerous modifications in the local circulation, an example is given on Chart XIV of a typical system of the normal and of the abnormal isobars, such as occur in a well developed cyclone for the month of February, upon which to base certain conclusions that are in fact sustained by the entire series, without any sort of contradictory or conflicting evidence. Chart XIV, figs. 67, 68, and 69 give the normal, and figs. 70, 71, and 72 the abnormal isobars on these planes.

The discussion can not be considered complete without joining with the isobars the corresponding systems of isotherms at all three levels, but in the present stage of our study it is not possible to do this with accuracy in the higher levels. The temperature conditions in the upper strata can not be reached by direct computation, as has been done with the isobars, until a very much more extended series of actual measurements than we now possess has been made by means of balloon and kite ascensions, such as are proposed at the Mount Weather Observatory. On this account the resolution of the isotherms into their normal and abnormal exponents is now limited to the sea-level plane, or rather, to the surface of the United States. An example is taken from the map of February 27, 1903, which is reproduced on Chart XV, figs. 73 and 74, where the isotherms are printed in red. The temperature components are formed by exactly the same method as was employed in resolving the isobars, the normal temperature system being taken from the Barometry Report. Fig. 73 gives the weather map, and fig. 74 the normal and abnormal isotherms.

THE GEOMETRICAL CONSTRUCTION OF HIGH AND LOW PRESSURE AREAS.

From the study of the isobars on the three planes, it is possible to draw several important conclusions which have the value of general principles. It was shown in the MONTHLY WEATHER REVIEW for February, 1903, fig. 25, "The formation of local anticyclones and cyclones in the general circulation about the poles," that the distribution of pressure commonly observed can be approximately reproduced by the superposition of systems of concentric circles, representing positive and negative local additions to the general circles of the hemis-

phere concentric about the pole. The charts of the year 1903 give the actual shape of the lines as they occur in nature, which are seldom concentric circles in their form. In the cyclone they more nearly resemble ellipses, which as a family have *one* focus in common, the other retreating as the area of the ellipse enlarges. In other words the isobars are crowded together on one side of the cyclone, as the northeastern, and opened on the opposite side. I explain this fact from the circumstance that the warm area and greater bouyancy of the air is on the crowded quadrant, so that a stronger tendency to true vortex action exists there than on the cold side, where the downward flow of the air tends to diminish vortex motion, that is to decrease the abnormal pressure gradients. This can be verified by examining the abnormal isotherms of Chart XV, for February 27, 1903. The major axis of the system of ellipses is pointed forward of the axis of symmetry of the entire circulation, generally the meridian, and makes an angle a with it. All possible relations of the ellipses to the axes chosen, as $x =$ the meridian, positive southward, $y =$ the parallel, positive eastward are contained in the equation,

$$(1 - e^2 \sin^2 a)\, y^2 - 2\, e^2 \sin a \cos a\, xy + (1 - e^2 \cos^2 a)\, x^2 + (2\, e^2\, d \sin a - 2\, b)\, y + (2\, e^2\, d \cos a - 2\, a)\, x + (a^2 + b^2 - e^2\, d^2) = 0.$$

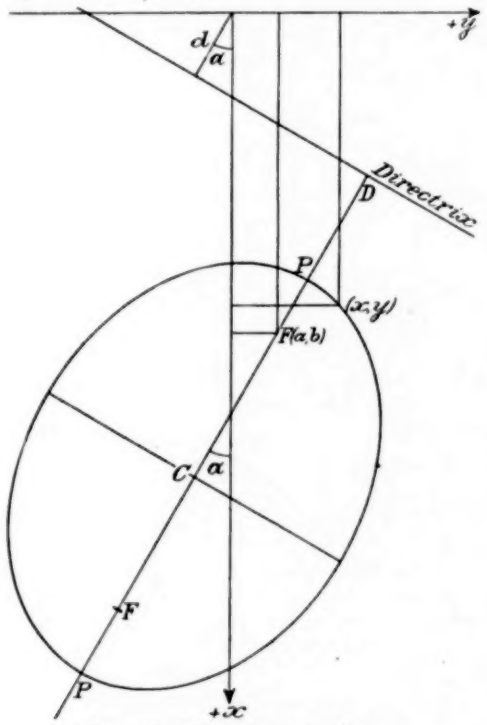

FIG. 75.—The general ellipse.

Let $(a\ b) =$ the coordinates of the focus F.
$(x\ y) =$ the coordinates of any point on the curve.
$d =$ distance of the directrix.
$a =$ the angle that transverse axis ($P\,P = A$) makes with x.
$A =$ the length of the transverse axis.
$B =$ the length of the conjugate axis.

$$e = \text{eccentricity} = \left(\frac{A^2 - B^2}{A^2}\right)^{\frac{1}{2}}.$$

$F\,C = A\,e =$ distance focus to center.
$F\,P = A\,(1 \mp e) =$ distance focus to vertex.
$P\,D = \dfrac{A}{e}(1 \mp e) =$ distance vertex to directrix.
$C\,D = \dfrac{A}{e} =$ distance center to directrix.

A much simplified case occurs where $d = 0$, $a = 0$, where the directrix is the axis y, and the transverse axis coincides with the axis x. For example, if $e = 0.57$, $d = 0$, $a = 10$, $b = 0$, $\sin a = 0$, $\cos a = 1$, the equation becomes,

$$y^2 + 0.67\, x^2 - 20\, x + 100 = 0.$$

The solution gives such point pairs as (6.4, 0), (8, 4.14), (10, 5.75), (12, 6.60), (15, 7.01), etc., from which the ellipse is to be plotted.

To illustrate the composition of two systems of isobars we take that of right lines and circles.

Let $R =$ the radius of the circle,
$(a, b) =$ the coordinates of the center,
$(x, y) =$ the coordinates of any point on the circle.

The general equation of the circle is,

$$(x - a)^2 + (y - b)^2 = R^2.$$

If we take $b = 0$ and transpose the terms,

$$y^2 = -x^2 + 2\,a\,x + R^2 - a^2.$$

The equation of the condition of the isobar which is the resultant of successive circular abnormal isobars added to successive right line normal isobars, is that the sum of certain pair numbers shall be constant on the same line. Thus, $A + B =$ constant, where $A = n\,x =$ some multiple, n, of the coordinate x, and $B =$ the gradient number on the circles. For example, take the gradient on the normal right lines one-half that on the normal circles, so that $n = \frac{1}{2}$, which is about the average in highly developed storms. Take successive circles, $R = 6, 5, 4, 3, 2$, whose gradient numbers are respectively $B = 0, -1, -2, -3, -4$. Take $a = 6$, $A = \frac{1}{2}\,x$, $A + B = 0$ for the 0-line and $n = \frac{1}{2}$.

TABLE 15.—*Form for computing the coordinates of the resultant curve.*

R.	B.	$A = \frac{1}{2}x$.	$y^2 = -x^2 + 2\,a\,x + R^2 - a^2$.	y coordinate.
$R = 6$	$B = 0$	$x = 0$	$y^2 = 0 + 0 + 36 - 36 = 0$	$y = 0$
$R = 5$	$B = -1$	$x = 2$	$y^2 = -4 + 24 + 25 - 36 = 9$	$y = \pm 3.00$
$B = 4$	$B = -2$	$x = 4$	$y^2 = -16 + 48 + 16 - 36 = 12$	$y = \pm 3.47$
$R = 3$	$B = -3$	$x = 6$	$y^2 = -36 + 72 + 9 - 36 = 9$	$y = \pm 3.00$
$R = 2$	$B = -4$	$x = 8$	$y^2 = -64 + 96 + 4 - 36 = 0$	$y = 0$

Similarly, by taking the proper groups of R, B, x, for the $-1, +1, -2, +2, \ldots\ldots$ lines in low and high areas, we obtain the coordinates of the resultants. The completed computation is shown on fig. 76. "Right lines and circles, where the gradients are twice as great on the circles as on the right lines." The preceding example plots the 0-line of the low area as will be seen by the pair points (0, 0), (2, ± 3.00), (4, ± 3.47), (6, ± 3.00), (8, 0).

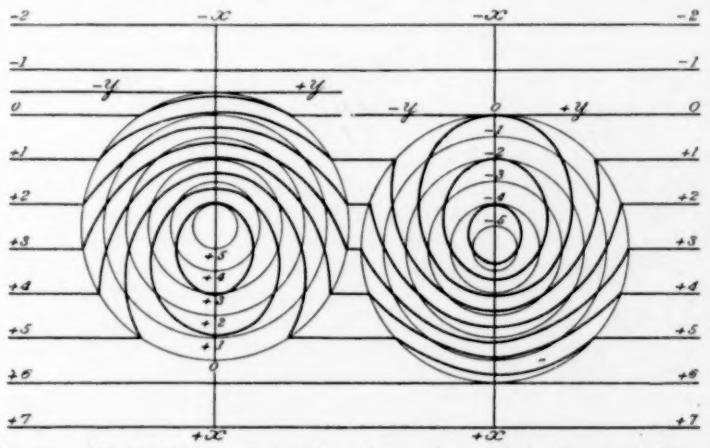

FIG. 76.—Right lines and circles where the gradients are twice as great on the right lines.

In this manner the simple cases can be readily handled analytically, and the principal is theoretically to be extended to all such groupes of curves as can be reduced to a mathematical expression. It is, however, evident that we can not obtain the equations for the observed isobars except in simplified cases, and that generally a graphical solution is all that can

be employed. Practically, one takes a sheet of normal isobars and places over it a sheet of observed isobars. Then, the differences at the points of intersection are marked in the sense that so many tenths of an inch must be added to or subtracted from the normal isobar to produce the observed isobar at that point. By joining up the points of equal difference numbers the system of the abnormal isobars for the day is obtained. The axes of the negative areas, *L*, have one nearly equal angle, *a*, with the meridian, but the axes of the positive areas, *H*, *H*, become convergent upon two cusps, *C*, *C*, fig. 70, Chart XIV, which tend to unite over a saddle, *S*, of relatively high pressure, separating the cyclone proper *L* from the wide spread region of low pressure lying beyond the axis.

THE CUSP FORMATION AND ITS CHANGES.

Between the isobars marked 0 and —1, in all levels, there is a line of pressure which is exactly the same throughout its extent, as indicated by the line of dots on fig. 11, 3500-foot level, MONTHLY WEATHER REVIEW, January, 1903. The rounded cusps of the typical abnormal isobars of Chart XIV become sharp cusps at that pressure, in contact at a central point on the saddle, and from this line the pressure falls in two directions, but rises in two other directions as shown on the typical figures. It is evident that by raising or lowering the pressure of the entire cyclonic region, the number of the closed curves inside the cusps can be diminished or increased. For instance in intensifying the cyclone the existing cusps advance and flow together, and then separate into an additional closed curve and an additional line at the top of the figure. If the pressure is diminishing, an inclosed curve advances to meet an outside line, and joining with it produces a new cusp, but at the sacrifice of an inside closed isobar. Thus, there is continued building or destroying of the closed central isobars going on in the action of the cyclones and anticyclones of the atmosphere in proportion to the energy of the circulation at any given level. Now, on passing from one level to another along the same vertical we find a similar increase and decrease of the cusp action, showing that in the same cyclone this difference of strictly cyclonic circulation exists.

The general rule is that *the number of closed isobars steadily diminishes with the height*, as shown on Chart XIV. Our maps give this structure in all stages of the development, from energetic storms with power to penetrate to considerable heights, to shallow storms which have become entirely depleted within two miles of the ground. In the winter the cyclonic circulation is exclusively in the lower strata, and is soon stripped away by penetrating the swiftly moving general circulation of the eastward drift. A remarkable fact has been developed, namely, that as the warm weather comes on and the power of the eastward general currents diminishes, the structure of the cusps and closed isobars is maintained at very much higher elevations. Thus, in April and May the 10,000-foot level is as much involved as the 3500-foot level is in January and February. I explain this by two facts: first, that the general currents in the lower levels of January and February have retreated to higher elevations in April and May, carrying the cyclonic structure with them; second, that in the warm months there is much more surface heat to dispose of in cyclonic action than in the winter, but that it must seek higher levels to find the cold air necessary to bring about the thermal equilibrium.

In the case of hurricanes, as shown in Paper No. V of this series, the cyclonic structure is powerful at the height of the cirrus levels, five to six miles above the surface, and this is in confirmation of the results of the Weather Bureau cloud observations of 1896–97, chart 35. It was shown in the same report that, taking the entire year, the maximum cyclonic circulation is in the strato-cumulus level, two miles above the surface, whereas in the winter it is lower and in the summer higher than that level. The cusp structure then diminishes with the height, but there is *no instance in which there is any sign that the closed isobars of low pressure reverse into closed isobars of high pressure over the same center.* The closed isobars are of the same sign till they are depleted and wiped out by penetration into the eastward drift. This is a conclusion without contradiction, and it is fundamental to cyclonic theories. Since the cyclonic circulation has an inward component, as is well known to be the fact, in the lower levels, it follows that it must have an *inward component in all levels* until it is absorbed in the upper strata. There is no reversal of the gradient system of isobars in the higher level as compared with the lower level, and *there can be no outflow in the upper level of the cyclone proper* unless it can be shown that there is a reversal of the isobars. The theoretical discussions which assume a reversal of gradients in the upper portions of the cyclones have no foundation in these observations, and all such observations as claim to have found in the cloud vectors of the upper levels a true outflow (Blue Hill, Hildebrandsson and others) have apparently not made the separation between the general and the cyclonic vectors with sufficient precision to escape this incorrect inference. It should be remembered that the Weather Bureau has reached the same result by three independent lines of research: (1) From the cloud observation at 150 stations for about twenty-five years; (2) from the theodolite and nephoscope observations of 1896–97 as given in the Cloud Report; and (3) from the barometric reductions now in operation over the United States and Canada. Furthermore, the theoretical analysis in the Cloud Report makes the solutions by a reversal of gradients entirely improbable, because they depend upon the *existence of warm and cold centers*, which it is well known do not in fact occur. This is easily seen by reference to Chart XV, or to thousands of such abnormal charts in the files of the Weather Bureau. I have already explained, as in fig. 28, MONTHLY WEATHER REVIEW, February, 1903, the process by which the rising air in a cyclone is stripped off by penetrating the eastward drift, involving an interchange of inertia between the local and the general circulations. Also, some further account of the analytic conditions are contained in Paper No. III of this series. It is really very difficult to secure true normal general vectors to use in vector subtraction from the observed vectors in all the subareas surrounding a low center, and in all the cloud strata, and it is no wonder that the work at a single station should be inadequate to such a resolution of forces. Such work has also been done with the prepossession of the old Ferrel meteorology of cyclones, which is very incorrect in many particulars. An inspection of the normal and abnormal isobars of Chart XIV shows that the normal isobars give increased gradients with the height, while the abnormal isobars give diminished gradients with the height, and there is no reason why there should be reversal in either the cyclone or the anticyclone, but simple decrease in the abnormal system until complete disappearance occurs where the general system dominates in the high levels.

It should be noted that while the example of Chart XIV shows that the saddle is directed northward, there are many cases in which the opening of the cyclone is turned to the other quadrants. Thus, the saddle is found frequently in the western quadrant, occasionally in the southern quadrant, and seldom in the eastern quadrant. The opening may often swing around to the northeast, but it rarely points between east and southeast. When the saddle is to the south in the lower strata, it is likely at the same time to be pointing to the north in the upper strata, showing a complete reversal of the structure within the same cyclone as to compass direction, but there is never a gradient reversal from low pressure to high pressure in the cyclone, or from high pressure to low pressure in the anticyclone, so far as known.

CRITICAL REMARKS REGARDING SEVERAL THEORIES OF CYCLONES AND ANTICYCLONES.

From the data in the possession of the Weather Bureau regarding cyclones and anticyclones, it is proper to lay down the following propositions:

(1). Currents of air of different temperatures counterflow in the lower strata of middle latitudes to produce the cyclonic and anticyclonic circulations.

(2). The maximum and the minimum of the abnormal temperatures, that is, the warm and cold areas, are located between and not at the centers of gyration.

(3). The configuration of the local isobars, as distinguished from the isobars that sustain the general circulation, is the same at all levels and of the same type as that at the sea level.

(4). These closed isobars diminish in number with the height until they disappear in the general circulation at moderate elevations, but they do not reverse from low to high pressure or from high to low pressure with the altitude.

(5). Currents of air stream continuously through the cyclone and the anticyclone, so that the circulation involves fresh masses and not a cyclic return of the same masses.

These principles seem to be so thoroughly established that they become criteria for the validity of several proposed methods of the analysis of cyclones and anticyclones, as given in well-known papers on this subject. In case any theory should conflict with the results of observations as given, then the observations must themselves be disproved, or else some substitute found for the theory in question. Several of them were worked out years ago, and had not the advantage of our modern observations, which have materially modified the point of view.

Ferrel's cyclone.—In this cyclone a bounding cylinder is drawn around the circulating mass, excluding it from contact with fresh masses (contra 5); it requires the maximum heat for a warm center cyclone, or the minimum heat for a cold center cyclone to be distributed symmetrically about the axis of gyration (contra 2); the system of isobars undergoes reversal along the axis, as in the warm center cyclone from low pressure at the surface to high pressure above, with corresponding inflow and outflow or reversal of the radial components (contra 3 and 4).

Oberbeck's cyclone.—This cyclone requires a symmetrical distribution of temperature about the center (contra 2); an increase in the vertical velocity in proportion to the height above the surface $w = + cz$, (contra 4), whereas the diminution in number of the closed isobars with the height implies a decrease, $w = - cz$; a concentration of the closed isobars of the inner region near its boundary of separation from the outer region where $w = 0$, (contra 3) since the usual concentration in one quadrant and separation in the opposite quadrant is due to the location of the warm and cold waves and not to a dynamic circulation.

Hann's cyclone.—The theory of cyclones as eddies in as tream having different velocities at the same level requires greater velocity differences in latitude than the general isobars which sustain the eastward drift will admit; since the velocity differences increase with the height, eddy cyclones should especially frequent the upper strata and increase with the altitude (contra 4), but they disappear where they should be strengthening; the temperature distribution as observed can not be continuously maintained on purely hydrodynamic principles.

Hildebrandsson's cyclone.—An eddy cyclone with inflow at the bottom and outflow at the top (contra 1, 2, 3, 4) seems inconsistent with itself, if the gyratory velocity has opposite directions above and below, as claimed to have been indicated in the diagrams and observations of the Blue Hill Observatory.

v. Bjerknes's cyclone.—(Compare Arrhenius's, Kosmische Physik.) This cyclone,deduced from the line integrations, requires warm and cold centers superposed (contra 3), and distributed symmetrically about the axis (contra 2); increase of the closed isobars followed by decrease with the height (contra 4), and varous internal circuits not found in the Weather Bureau observations.

Meinardus describes stream lines based upon the Oberbeck cyclone, and the exposition has to encounter the difficulties mentioned above.

Shaw describes a special case motion quite in conformity with the stream lines in tornadoes, waterspouts, and hurricanes, but not in agreement with such a complex circulation as is found in cyclones of the United States, and typified in Chart XIV.

If these objections continue to be sustained by future observations, it follows that true analytical discussion of the forces in cyclones and anticyclones must avoid such mistaken assumptions as have been laid at the basis of much mathematical meteorology. The actual circulation is really complex in individual cases, and yet it is not difficult to see what in the main the leading principles must be. Further examination of the distribution of the temperature in the higher levels is next in the order of the research.

THE CAUSE OF THE COUNTERCURRENTS IN THE LOWER STRATA.

Ferrel's conception of the general circulation, as derived from a canal theory, where the hot air of the Tropics rises and flows toward the poles in the higher levels, fails to give sufficient account of the persistent southerly winds in the lower strata. Referring to Paper III, of this series, "The problem of the general circulation of the atmosphere of the earth," MONTHLY WEATHER REVIEW, January, 1904, the following remarks suffice. If the temperature of the Tropics is T_1 and of the temperate zone is T_2 in normal conditions, while the heat energy of the Tropics is Q_1 we shall have for the work,

$$W = \frac{Q_1}{T_1}(T_1 - T_2),$$

in average seasonal relations on the rotating earth. Since the solar insolation tends to raise T_1 to $(T_1 + \Delta T_1)$ in the Tropics, and polar radiation changes $- T_2$ to $-(T_2 + \Delta T_2)$, we shall have an increment of work,

$$W + \Delta W = \frac{Q_1 + \Delta Q_1}{T_1 + \Delta T_1}\left[(T_1 + \Delta T_1) - (T_2 + \Delta T_2)\right].$$

Where

$$\Delta Q_1 = (\lambda C_v + \mu C_v^1)\Delta T + A(\lambda R + \mu R_1) T \frac{dv}{v}$$

by formula 112, Cloud Report. The question depends upon the expenditure of the work ΔW, whose purpose is to restore thermal equilibrium as promptly as possible.

The Weather Bureau data show that a system of irregular currents of warm air flow from the Gulf of Mexico upon the United States in the lower strata, and are primary components in the cyclones, where mixing of the currents of air at different temperatures is taking place. These warm streams reach the place of mixture by flowing a short distance across the general high pressure belt, where there is no east and west velocity to complicate the action through an interchange of inertia between the normal masses and the extra currents. In the canal circulation there is on the other hand great opportunity for changes of inertia in both senses, and this the currents tend to avoid unless it is forced upon them. Thus, the warm air of the Tropics in rising first passes to strata of decreasing velocity; then, in moving northward, to strata of increasing velocity; and, finally, in descending in the temperate or polar zones, to strata of diminishing velocity. It is apparent, therefore, that the over-heated masses in the Tropics seek the temperate zone, where they encounter cooler masses, by a short and simple path rather than by a long and very complex path. The tendency for currents of high temperatures to remain individually intact as long as is possible is an additional reason for seeking the cyclonic belt by a direct path in the lower and nearly quiet strata.

Similar reasoning applied to the polar zones gives a sufficient account of the cold western current that enters the cyclone. The warm current on the eastern side underflows the eastward drift, rises into it, and allows the cold current from the northwest to flow beneath. This starts a gyration which is developed as shown by the observations described, and it continues to act as long as the feeding countercurrents of different temperatures endure. The mixture with the eastward drift propels the structure forward, and at the same time breaks up the heated air coming from the Tropics into a succession of irregular cyclones and anticyclones. The mutual reactions between the constituent parts are so numerous and so subtle that it is not easy to distinguish exactly where one set of forces, as the thermodynamic, ends, and another, as the hydrodynamic, begins. This interplay is, no doubt, responsible for the perplexity that meteorologists have encountered in establishing the correct theory of cyclonic action.

PRECEPTS FOR FORECASTING WITH THE CHARTS ON THE 3500-FOOT AND THE 10,000-FOOT PLANES AS AUXILIARIES.

The chief object in preparing auxiliary pressure and temperature charts on two planes, 3500 feet and 10,000 feet, above the sea level, was to secure three sections through the lower parts of a storm, so that their mutual relations might be studied for the purpose of improving the forecasts. They have proved to be of interest not only in theoretrical meteorology but also in forecasting, as will be more fully set forth in the full report. It has been thought proper by the Chief of the Weather Bureau to give them a practical test at the Washington office during the coming winter before deciding what emphasis shall be placed upon them. It should be clearly understood that they are intended simply to supplement the usual sea-level weather map, as auxillaries of any other kind are employed, such as the pressure-change maps, and the cloud maps now in use in forecasting. It will be necessary only to use a two-syllable code word, as the pressure-temperature word for telegraphing the fractions of the inch of pressure on the two planes, since the integral inches can readily be inferred. The study of these charts has developed many new ideas which it would be impossible to explain in a short paper, and there is no little novelty of thought involved. It will require practise to make good use of all three charts simultaneously, as they are very different from one another, but as there may be some interest in the matter among the forecast officials I have added certain precepts or brief statements, derived as the result of my own experience and studies.

1. *Direction of the storm tracks.*—These follow closely the trend of the isobars on the 10,000-foot plane, reference being made to the 10,000-foot isobars that are closely packed together and are lying well to the south of the center of the cyclones, no regard being paid to the northern curves which are distorted by other influences and represent special features of the circulation.

2. *The velocity of advance.*—This is very closely proportional to the density with which the isobars south of the cyclone are compressed, a strong gradient indicating a quick advance, while a wide gradient with straggling isobars indicates that the velocity of the movement will be slow.

3. *The areas of precipitation.*—To the eastward of the Rocky Mountain Divide these are approximately marked out by the crossing of the isobars on the 3500-foot plane at a good angle beneath those on the 10,000-foot plane. This is especially true of the months from November to April, inclusive. In the summer months, May to October, if the two sets of isobars are crowded together and nearly parallel, there is probability of rainfall in the midst of them. This rule seems to be nearly true for the north Pacific and north Plateau districts throughout the year. The relative positions of the low areas and the high areas is of great significance. On the Pacific coast when a high area is to the south and a low area to the north, these crowded isobars bring precipitation when they run directly from the ocean to the land. If the high area is well to the north, with the low area far inland, and the isobars run from the northwest or north, the tendency to cause precipitation is much diminished. The area of precipitation is on the *western* side of the cyclones of the middle and north Plateau districts, but it shifts to the *eastern* side as the cyclone passes over the Rocky Mountain slope. This makes difficult the forecasting for precipitation in the States of the slope.

If the cyclone is on the southern Plateau or the southern slope and a high area is to the eastward in the Gulf States, the 3500-foot isobars usually open out widely to the south and the region of the underflow marks out the precipitation area very definitely. If the cyclone is located far to the north, over the Missouri Valley, the southern ends of the 3500-foot isobars are usually smooth, unbroken curves, and although there may be a well-marked underflow region, the precipitation area is to be made much smaller than in the preceding case and placed well around on the north side of the cyclone. The precipitation area is apt to be confined to the closed isobars surrounding the center. The difference between these cases lies in the fact that the underflowing current in the southern cyclone is full of moisture from the Gulf of Mexico, but in the northern cyclone it is much drier, even to the extent of being without precipitation. The two types here mentioned will require study and practise for their differentiation, but a working knowledge of the difference is easily acquired. When the cyclone is east of the Mississippi River, its passage eastward or northeastward is closely controlled by the 10,000-foot plane isobars. If the cyclone is on the Atlantic coast, a high-pressure area following it from the southwest should be interpreted as meaning that a rapid clearing will follow over the region of precipitation in the rear of the cyclone. When the cyclone is over the Lake region and a second depression is over the Gulf of St. Lawrence, if the isobars loop northward over the Middle States between the two lows, the area of precipitation is quite general from New England to Minnesota.

4. *Penetration into the higher levels.*—In the winter months, December to March, the heads of the cyclones do not penetrate very much above the two-mile level, but in the summer months, June to September, they are apparently about four miles high. In these seasons, respectively, the power of an individual storm is measured by its penetration into the higher levels and is proportional to it. In the winter the upper strata are cold and drift rapidly eastward, and these two causes deplete the intruding cyclonic head; in the summer the cool strata are much higher and they move slowly, so that an uplifting cyclone finds little to check its development. This principle is seen, also, in the action of cumulo-nimbus clouds in summer. Allowing for relative differences of the seasons, the action of the upper strata upon cyclones is always essentially the same.

While there are several such general principles as these to be acquired by practise, it is yet true that the distinctive weather types are fewer in number and simpler in form on the 3500-foot and the 10,000-foot planes than on the sea level, and apparently their action is much less fluctuating and deceptive. This is a decided advantage in studying the forecast problems, which now suffer by their great complexity on the sea-level plane. In any preliminary study of the new charts there is likely to be some confusion of mind, due to the novelty of the isobaric structure and the intrinsic differences of configuration between the several planes. This mental state will be cleared up by practise, and it will be found that a real addition has been made in the understanding of the prevailing storm action. Further advantage to be derived from an introduction of the isotherms on the upper planes will probably increase the efficiency of this system in other ways.

THE SENSATION OF DISCOMFORT.

By W. F. TYLER.

Under date of April 14, Mr. W. F. Tyler, Coast Inspector of the Imperial Maritime Customs Service, China, and in charge of the meteorological affairs of that service, writes from Shanghai as follows:

For the last few years I have given some attention to the question of a means for comparing climates, and have directed my little investigation toward ascertaining the relation between the subjective effects and the physical elements of climate. This eventually resolved itself into trying to find out what function "discomfort" is of temperature and humidity. I found that taking zero as a condition when, being suitably dressed, no personal discomfort is experienced, and 10 as the maximum discomfort known in Shanghai; then within the range of my observations the degree of discomfort is given by the expression

$$\frac{d - 1.2(d-w) - 66}{3}$$

where d and w are the readings of the dry and wet bulb, respectively. The range of my observations was from 0.2 to 0.6 of the maximum discomfort.

Now it seems to me that there is an important principle concerned in my method of dealing with this matter, namely, the graduation of sensation.

The estimation of degrees of sensation is, of course, only a means to an end. When the law connecting such degrees with the physical cause or causes has been ascertained, it will be possible to foretell what, under certain physical conditions, the degree of sensation will be.

In England I have experienced great difficulty in attracting any attention to my idea, the objection to it appearing to be that as it deals with a mental phenomenon it could not be viewed from the ordinary scientific standpoint.

But I have thought this nonappreciation might be at all events partly due to the want of experience of extreme climates. They have never had the opportunity of comparing, say, a temperature of 84° F. and a saturated atmosphere with a temperature of 100° F. and a relative humidity of 55 per cent. According to my scheme these two conditions cause the same degree of discomfort.

In your country, however, it is otherwise, and you have every condition of climate. The question then of comparison of these must be of the greatest interest. It is possible that this subject has already been dealt with in your country on somewhat the same lines indicated by myself, but if so it is curious that I have heard no reference to it in England.

In connection with the above letter, Mr. Tyler sends a copy of an article entitled "A scheme for the comparison of climates", reprinted from the Journal of Balneology for February, 1904. In this paper he maintains that there are two factors affecting human sensation incomparably more important than any others, namely, temperature and humidity, and that the same sensation of climate may be experienced by adjusting the temperature and humidity in accordance with the law expressed in the above equation. Other factors, such as soil, wind, aspect, rainfall, and altitude are appreciable, but temperature and humidity are the most important, and he expresses the joint effect of these two by the word "Hyther" (hygrometer and thermometer?). If this fundamental combination can once be determined, then the effects of pressure and sunshine may possibly also be expressed. It may, also, be possible to determine the extreme conditions of temperature and humidity in which human life can exist.

The want of an exact nomenclature for our sensations is felt as soon as we consider the immense range of climatic conditions.

In south Australia, with a shade temperature of 115° F., men wear starched collars and work in their offices without punkahs, while in Shanghai, with a shade temperature of 95° F., life may be rendered hardly worth living, even with cellular shirts and electric fans. How climate affects us is certainly not indicated on the thermometer or on any other existing instrument. It is indicated only by our bodily sensations, and our object is to find some way of describing these. * * * If any sensation, such as that caused by immersing the hand in water, is considered, and two definite limits are taken, such as water so cold that it makes one shiver, and so hot that it can just be borne, then the writer maintains that with practise the mind is capable of graduating this sensation into say ten equal parts, each corresponding with an equal difference of sensation, Undoubtedly all minds are not equally capable of this. Out of twelve selected observers there were only three with fairly good indicative qualities. About the end of the summer of 1902, observations were made by twelve individuals in Shanghai over a period of one month. Each estimated daily, at noon, the sensation caused by the warm climate supposed to be the combined effect of heat and humidity, and each recorded the degree of hyther on a scale 0 to 10. Ten represents the very worst day that each observer remembers to have experienced in Shanghai, namely, hot, damp, and enervating; zero represents an ideal summer day, warm, bright, brisk, and bracing, when, being suitably dressed, one suffers no discomfort from temperature or humidity. The observers were of regular habits and accustomed to the same daily occupation at noon and without rush or worry. The corresponding meteorological observations were made at Zi-Ka-Wei Observatory. The individual observations are given in tabular form, as well as graphically. In each diagram the horizontal line represents degrees of dry-bulb temperature, and the vertical line represents the depression of the wet-bulb thermometer. The observer's estimated sensation on the scale of 0 to 10 is inscribed on the diagram [1] at the place shown by the intersection of the line of corresponding temperature and wet-bulb depression. Then lines are drawn connecting points of equal sensation. In the majority of cases the numbers or hythers do not seem to be arranged in simple curves or zones, but in general the higher and the lower numbers can be divided by a line that has about the same slope in all the diagrams. If, however, a mean is taken of all the numbers, the zones are fairly well defined. The preliminary study seems to show that temperature and humidity are of primary importance, but that some other factors have appreciable influence. As the record is given only for one month and the observers had no previous experience, it is not advisable to state conclusions too definitely. But one generalization seems to be allowable, namely, that the lines of equal comfort, or the zones of hythers, all run in approximately parallel directions, showing that the law governing the relation of humidity to temperature is similar in all cases.

As the reader is perhaps unacquainted with the rather extensive literature on this subject, we may perhaps refer him to the observations and writings of J. W. Osborne, of Washington, in the years 1872-1875, published principally in the Proceedings of the American Association for the Advancement of Science. Mr. Osborne also devised a scale of sensations expressed by both terms and numbers. He also constructed a very ingenious vessel of paper filled with warm water, whose temperature could be kept at any desired point, representing the balance between the heat lost by evaporation from the surface and that given to it by the air, and, therefore, to a certain extent corresponding to the temperature of the moist human skin. Mr. Osborne's observers took account of the wind as one of the most important climatic factors. For a long time the temperature of the wet-bulb thermometer was known as the "sensible temperature" or a temperature approximating that which might be supposed to represent the sensations that we experience, but this is evidently a very crude method of disposing of the subject, and has long since been given up. The idea of a curve of comfort, as explained by the Editor at pp. 362-3, MONTHLY WEATHER REVIEW, August, 1898, is quite analogous to the curve of discomfort as explained by Mr. Tyler. In both cases we seek a relation between some definite physiological condition and the temperature, moisture, wind, or other atmospheric condition. The preparation and study of these curves seem to offer the most practical method of recording and studying the relation of the weather to the condition of the nervous system.

THE PRESSURE OF SUNLIGHT AND SOME OF ITS BEARINGS ON ASTRONOMY AND METEOROLOGY.

By S. A. MITCHELL, Columbia University, New York, dated May 19, 1904.

How science changes its point of view and adopts new hypotheses as occasion demands is splendidly illustrated by the story of comets and their tails. Since the first explanations of the strange behavior of these tails given nearly three hundred years ago, even before the foundation of the law of gravitation, there have been plenty of theories propounded, and earlier ideas have been gradually discarded on becoming untenable through improved knowledge of the laws of matter.

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[1] The diagram is not reproduced.

The life history of a comet, indeed, seemed to contain a riddle which no astronomer could fully read, and as such it was regarded as one of the "problems of astronomy." Newton's law of universal gravitation itself appeared to be set at naught by comets' tails, for instead of pointing toward the sun, as being attracted in this direction by gravity, they pointed in diametrically the opposite direction, just as if under the action of a solar repulsion. Could this be a case which showed that gravity was not universal? Or if gravity did act, what was the nature of the force centered in the sun, but which repelled matter so as to form the tail? Various theories of comets' tails have resulted from attempting to find the nature of this force.

After investigating planetary motions and giving to the world his three great laws of motion, Kepler turned his attention to comets. In 1608 he announced that to the best of his knowledge the head of a comet becomes vaporized by the heat of the sun, and that particles are driven therefrom to form the tail by a force of repulsion that was explained easily enough by the then accepted theory of light. According to this theory the sun is continually emitting particles of matter which travel through space at enormous velocities. On reaching the comet a portion of the energy of these corpuscles becomes imparted to the cometary material, and there results a tail pointed away from the sun.

Newton, in 1687, did not entirely accept this explanation. While believing implicity in the emission theory of light, he tried to prove that gravity was universal, and consequently that all celestial motions were the result of gravitation, and, therefore, he thought the repulsions producing comets tails were apparent only, and not real. This made it necessary for him to imagine that the universe was filled with a gaseous medium denser than the matter forming the tails, and in which they were buoyed up as the smoke of a locomotive floats in air.

Euler, in 1744, seemed to have clearly seen the difficulties in the way of assuming, with Newton, a gaseous medium throughout space, and returned to the first ideas of Kepler. However, he no longer believed that light consisted in the emission of material particles, but thought it, as we do now, to be the result of wave motion. The repulsive force took its origin, according to Euler's ideas, from mechanical impacts caused by these waves.

The chief advance in the history of comets during the eighteenth century was to show that a comet's head obeyed the law of gravitation, even if its tail did not. Halley calculated an orbit for the comet that he observed in 1682, and finding that this comet described the same path as those observed by Peter Apian in 1531, and Kepler in 1607, predicted that it would appear in 1758–59.

So fully was he alive to the importance of the announcement that he appealed to "candid posterity," in the event of its verification, to announce that the discovery was due to an Englishman. The prediction was one of the test questions put by Science to Nature, on the replies to which largely depend both the development of knowledge, and the conviction of its reality. * * * Halley's comet punctually reappeared on Christmas Day, 1758.

The nineteenth century at its beginning had Olbers to rely on to clear away the difficulties by his pioneer work on the motion of comets. "Olber's method" of determining the orbit of a comet was universally adopted, and at the present time is still regarded as the most expeditious and convenient method of calculation when extreme refinement is not required. Although only an amateur in astronomy (he was by profession a physician), his name stands writ in large letters in the history of cometary discoveries. In his time electricity was beginning to be studied, and its phenomena to be investigated by the experiments of Coulomb, 1785. In electricity was manifested, for the first time, repulsions between material particles. The investigations of Olbers showed him that the heads of comets obeyed implicitly the law of gravitation, but on the other hand the tails acted as if repulsed from the sun. After discarding, in 1812, the views of both Kepler and Newton as untenable, since they could not be based on experiment, he very naturally assumed that these forces might be "something analagous to our electrical attractions and repulsions." This explanation, to be valid, should rest on two physical facts; first, that the sun has a constant electrical charge, and second, that the comet's tail is charged with electricity of the same sign as that of the sun. However, at the present time, we know nothing of the electricity of the sun, except through its magnetic effects on the earth, and we do not even know whether the sun's charge is plus or minus.

Since electricity explains repulsions, it is easy to see why the theory of Olbers should be accepted and held, even up to the present time. As the force due to electricity decreases with the square of the distance, as also do light, heat, and gravitation, Bessel was able, in 1836, to compute the magnitude of the repulsion from the curvature of the tail of the comet of 1811. Since 1870 the Russian astronomer, Bredichin, with this idea, has measured the curvatures of about forty comets, and has found their tails to be of three types:

1. Long, straight tails, for which the repulsive force is 18.5 times the sun's gravitational attraction.
2. Plume-like tails, with a repulsion 3.2 times gravity.
3. Short, stubby tails, with a repulsion of 2.0 and 1.5 times the attraction of gravity.

The electrical theory seemed to furnish a satisfactory explanation of repulsive forces, and it was accepted by Bredichin. The attraction due to gravity depends on the masses of the particles acted upon, while the magnitude of the repulsive forces varies in amount according to the surface area. If the particles that make up a comet's tail are all of the same mass they will be attracted to the same amount by gravity. If these particles are of different substances, those with the least density will have the largest volume and area, and hence the magnitude of the electrical forces will be greater, and so will vary inversely with the densities of the substances. According to Bredichin, therefore, the long, strait tails consist of hydrogen, the curved, plume-like ones are of hydrocarbons, while the third tail is made up of metallic particles, chief among which are iron and sodium.

The spectroscope has shown that these metals are in the head of a comet, and they are of about the correct specific gravity to give the repulsions calculated from the curvature of the tails. But no comet has been bright enough to thoroughly test the light of the tails spectroscopically, and the proposition of Bredichin is still only a hypothesis, but one, unfortunately, with no sound physical basis.

Very different, however, is it with the very recent theory of Arrhenius, the Swedish physicist, which explains nearly all the phenomena connected with comets' tails by means of the pressure of light. As long ago as 1873 Clerk Maxwell propounded the electromagnetic theory of light. One direct consequence of this theory is that light must exert a pressure on every surface on which it impinges. Maxwell was able to calculate the pressure of the sun's light at the surface of the earth, but the amount is too small to be detected even by our modern delicate methods of measurement. Very much greater, however, would be this pressure at the sun. To visualize our conceptions, let us imagine at the surface of the sun a cube of water, one centimeter each way. The pressure exerted by the sun's light amounts to 27.5 by 10^{-4} grams. As superficial gravity is 27.47 times greater on the sun than it is on the earth, the cube of water weighs 27.47 grams at the sun, instead of one gram as on the earth, and consequently the weight, or attraction by the sun, is ten thousand times the pressure or repulsion due to the sun's light at the sun's surface. If we imagine the size of the water drop decreased, the weight decreases as the cube of the side, while the pressure only as the

square, and thus the weight decreases the faster; and if the water particle is one millimeter each way the attraction of gravity is only one thousand times the repulsion due to light. And so, if the cubic drop of water is one one-thousandth of a millimeter on each edge, the attraction of gravity is just equal in amount to the repulsive pressure of light. Make the size of the water particle any smaller and it will be driven away from the sun, acting exactly as if gravity had become negative. The one-thousandth part of a millimeter, or the one-millionth of a meter, is called a *micron*, and is usually denoted by μ. This is the unit of length employed to measure the vibrations of light. If the drops of water were spherical instead of cubical, as considered above, the critical diameter, when the attraction is just equal to the repulsion, would be 1.5 μ. We are not unfamiliar in nature with particles of matter of this size. Particles of lycopodium powder have a diameter perhaps equal to 2 μ.

On a trip to Sumatra to view the total eclipse of the sun on May 18, 1901, with an expedition from the United States Naval Observatory, the writer had a splendid opportunity to see the volcano Krakatoa. The jagged appearance of the northwestern portion of the island showed very clearly where a quarter of it had been blown away, and where had formerly been a hill nearly a mile in height the ocean has crept in and bottom can not now be found with soundings of 1000 feet. The explosion which caused such remarkable changes in the configuration in the Straits of Sunda was the most terrific of which we have any record. The tidal wave resulting from it carried a Dutch man-of-war on the coast of Sumatra a mile and a quarter inland and beached it 76 feet above high-water mark, and this wave, which was felt even in the English Channel, 11,000 miles away, caused a loss of 40,000 lives. The air wave sent out by the explosion was traced by barometers through seven complete circuits of the earth, and the noise of the explosion was heard even in the island of Ceylon, 2000 miles away. Large quantities of dust were thrown up to great heights and in such a finely divided state that many months were required for it to descend to the earth's surface. This dust was carried by winds and air currents to all quarters of the globe, and there resulted the brilliant and beautiful sunsets of 1883. Since the small particles of matter were suspended in the air for such a long space of time, they must, indeed, have been almost infinitestimal, with diameters comparable in size with μ—the one-millionth of a meter.

Therefore, in putting forward a theory of comets' tails where the force of repulsion is the pressure of light exerted on particles whose diameters are of a magnitude approximating this small fraction of a meter, Arrhenius is not proposing an impossible theory, at least as far as the size of the particles is concerned. Theoretically, the pressure of light follows as a direct consequence from Maxwell's theory of light, and if this pressure could in any way be found by experiments in the physical laboratory the whole proposition of Arrhenius would have a secure foundation. Quite recently, Professors Nichols of Columbia University and Hull of Dartmouth, working together, have performed some interesting experiments, and have succeeded in making a laboratory comet's tail. This wonderful result was obtained by putting into an hour glass, from which all the air had been carefully exhausted, a mixture of emery and lycopodium powder. The hour glass was held vertical in order to allow the powders to run through, and at the same time a strong horizontal beam of light was directed at the small part of the glass. The repulsive action of light pressure on the emery was such a small fraction of the attraction of gravity that there was practically no deviation from the vertical. For the smaller particles of the lighter powder repulsion and attraction were more nearly equalized; they were deflected from the vertical direction, and the illumination caused a resemblance to a comet's tail that was very striking indeed.

Since there is such a sound scientific basis for this light-pressure theory, let us see how comets' tails are probably formed. The attraction of gravity decreases as the square of the distance from the sun; so also do the heat, the electrical forces, the intensity of the sun's light, and the pressure due to this light. Therefore, the ratio of the attraction of gravity to the repulsion due to light pressure will be the same no matter what the distance of the comet from the sun, and will depend only on the size of the particles forming the tail. A particle whose diameter is greater than a certain critical diameter will be attracted toward the sun, and those less than this critical diameter will be repelled from the sun. The spectroscope tells us comets are made up mostly of hydrocarbons, the critical diameter for which is 1.9 μ. When the comet in its orbit approaches the sun, some of the materials of which it is composed are volatilized by the sun's heat. The form of the comet's tail depends on the size of the drops into which the vapors condense. If they have diameters greater than the critical value they will move toward the sun and form a tail in this direction, as has been seen many times. If the drops are smaller they will move away from the sun, and tails of different curvatures will result, depending on the size of the cometary particles (the comet of 1744 had no less than five tails).

From the curvature of the tails Bredichin calculated the repulsive forces for four separate tails to be 18.5, 3.2, 2.0, and 1.5 times gravity. On the light-pressure theory of Arrhenius, the size of the particles forming the tails would in the four cases be 0.1 μ, 0.59 μ, 0.94 μ, and 1.25 μ.

This theory clears away most of the difficulties in the way of explaining the strange appearances of comets and their tails, and in particular tells why a comet like the great one of 1882, which was 200,000 miles in diameter at the head, 10,000,000 miles in diameter at the extremity of the tail, and 100,000,000 miles in length, is able to swing around close to the sun in a few hours, and still have the tail directed away from this sun of ours, which has a volume over a million times greater than that of our earth, but which, nevertheless, is only one eight-thousandth part of the bulk of the comet. The tail, strictly speaking, is not an appendage of the comet, but is formed of materials that are continually being sent off into space. Kepler, three hundred years ago, was undoubtedly right when he said that comets were consumed by their own emissions, "Sicut bombyces filo fundendo, sic cometas cauda exspiranda consumi et denique mori."[1]

This theory is of such exceptional interest to the astronomer that the writer has sought to find what information the comet of 1903 could give on this subject. From a popular standpoint, the appearance of this comet last summer was a great disappointment. Bright at its discovery, a close approach to the sun, and visible all night in the northern heavens, it was thought that the comet might become very conspicuous. It was at no time brighter than the second magnitude, and possessed a tail only a few degrees in length. This comet was photographed nearly every clear night by Mr. Sebastian Albrecht, at the Lick Observatory. From the curvature of the tail, as measured on the photographic plates, the writer has calculated the force of repulsion emanating from the sun that caused the tail. It was found that there were tails of three separate curvatures, corresponding to repulsions of 18.4, 1.8, and 1.4 times gravity. The first of these is the prominent tail, and on Bredichin's theory would be composed of hydrogen. The diameters of the particles forming the three tails of the comet of 1903 must have been 0.1, 1.0, and 1.33 microns, or millionths of a meter.

We conclude that the only satisfactory hypothesis to account for the many peculiar phenomena of comets' tails is the recent

[1] De Cometis, Op. Vol. vii, p. 110.

one of Arrhenius, that the force causing the apparent negation of the law of gravity is the repulsion due to the pressure of sun light.

The preceding article by Dr. S. A. Mitchell presents in a popular way the present condition of our knowledge of the subject that was first discussed, in 1619, by Kepler, whose views were considered quite plausible by Sir Isaac Newton. A more technical description of the steps by which the pressure of light has finally been demonstrated, experimentally, is given in two papers by Professors E. F. Nichols and G. F. Hull, published in the Astrophysical Journal for June, 1903, pp. 315-360.

As many readers of the REVIEW may be surprised at the results of this computation of the effect of the pressure of a beam of light, and may wonder what the computation of the curvature of a comet's tail has to do with meteorology, the Editor would call their attention to the fact that several computations of the sizes of vapor dust particles floating in the atmosphere have led to results similar to those above given by Dr. Mitchell, so that it is quite plausible that the action of sunlight on the dust floating in the uppermost layers of our atmosphere may give rise to interesting meteorological phenomena.

The so-called zodiacal light is apparently due to the reflection of sunlight from extremely small particles arranged as a ring, which according to some authorities encircles the sun, but according to others must also encircle the earth. The Bishop's ring and other large halos around the sun are undoubtedly diffraction phenomena, produced by the action of minute particles upon sunlight; the size of the particles can easily be calculated. In the American Meteorological Journal, vol. 5, April, 1889, p. 539, the editor has given the formula and calculation executed by himself in 1884, when Bishop's ring was first observed in Washington. For red light and 15° as the radius of the halo, the diameter of the particles that caused the diffraction ring was 0.0001 Paris inch, or 2.7 microns. A micron is the thousandth of a millimeter, and is usually designated by μ. Smaller particles would make a larger ring. In the voluminous report of the committee on the eruption of Krakatoa, at pp. 232-269, Mr. E. D. Archibald has given the views and calculations of several students of the subject. Thus, p. 248, Riggenbach and Kiessling locate the "dust" that formed the Bishop's ring and the red twilight glows at altitudes in the atmosphere varying from 5 to 22 kilometers, depending on the phases of the phenomena. On p. 257, various calculations are given as to the size of these particles, based on various views as to the optical phenomena. The figures vary between 0.003 millimeter as given by Forel, and 0.001 as given by Floeger.

It will be seen, therefore, that the red twilight glows are apparently explained on the assumption that we have floating in the upper air minute particles of a size comparable with those that Dr. Mitchell has computed for the tail of the comet of 1903. As to the exact nature of these particles, it may be that our use of the word "dust" is slightly misleading. Professor Barus, in his exhaustive researches on the condensation of vapor in the atmosphere, has shown that every substance, whether solid or liquid, is giving off emanations that are probably either molecules, atoms, or corpuscles, and that these constitute the nuclei of the condensation. These may be analogous to the particles of dust, so called, that are floating in our upper atmosphere and in interplanetary space.

We have in the aurora borealis a phenomenon that is as yet only imperfectly understood. Evidently some component of our atmosphere becomes visible. Whether that be helium or argon or nitrogen, as the spectrum suggests, or whether it be this molecular dust; whether the luminous substance causes magnetic disturbance, or, vice versa; whether the disturbance goes from the earth outward, or comes from outer space inward, are questions still under discussion.

We know that Krakatoa sent its dust outward, while meteors and comets may bring their dust to us inward. In either case, the sunlight would act upon them alike, and the study of the phenomena going on many miles above the ground can not be neglected by that modern meteorology which aims to study the whole atmosphere by every method that can be devised.—ED.

THE PROMOTION OF METEOROLOGY.

During the recent session of the Fifty-eighth Congress, Senator Bard, of California, at the earnest request of one of his constituents, introduced a bill (Senate bill No. 5277) "To promote further discovery and research in meteorology," which was read twice and referred to the Committee on Agriculture and Forestry. The originator and special promoter of this bill, an active attorney of Los Angeles, Cal., and friend of a well known long-range planetary forecaster, announces that he desires the bill to stand on its merits. The Chief of the Weather Bureau and his staff of advisers are not able to see any merit in the bill. The promoter sent a copy to Prof. J. M. Pernter, Director of the Central Institute for Meteorology at Vienna, Austria, whose lecture on forecasting had been published in the MONTHLY WEATHER REVIEW for December, 1903. As Professor Pernter has sent us a copy of his reply, we take pleasure in printing the correspondence, as he suggests.

Letter from the Director of the Imperial Royal Central Institute for Meteorology and Geodynamics.

[Translation.]

VIENNA, HOHE WARTE, *May 26, 1904.*

DEAR COLLEAGUE: I learn that the Weather Bureau has translated my lecture "Allerlei Methoden das Wetter zu prophezeien" (Various Methods of Forecasting the Weather) into English, and distributed it to its observers. Some of these observers have addressed letters to me on the subject; in particular an attorney in Los Angeles has not only written, but has communicated to me a bill introduced by Mr. Bard in the Senate of the United States on March 26, 1904. In his letter this gentleman says that it was he, himself, who caused the bill to be introduced by Senator Bard. He asks whether I am not of the opinion that by means of this bill one would attain to the correct physical principles of weather forecasting? I have replied to his question and send you, herewith, a copy of my answer to be made use of as you may think proper.

However, I see that the bill, after its second reading, was referred to the Committee on Agriculture and Forestry and will, therefore, for the time being remain in conference. Were I an American, I would have my letter published in some American magazine or newspaper in order to prevent this bill from becoming law. If you think it advisable to publish it, you are at liberty to do so.

May I ask you to send me a copy of the translation of my lecture "Allerlei Methoden, etc.?"

With the highest regard, I remain, very respectfully,

(Signed) J. M. PERNTER.

Copy of the letter above referred to.

[Translation.]

CENTRAL INSTITUTE FOR METEOROLOGY AND GEODYNAMICS,
Vienna, Hohe Warte, May 21, 1904.

DEAR SIR: The object sought to be attained by the bill is very well considered and important; it is much to be desired that large sums of money should be devoted to the promotion of good forecasts of the weather and especially to the discovery of the physical basis of weather forecasts, since the ultimate attainment of this object is worthy, not only of the labor of the noble, but also of the treasure of the state.

While, therefore, I welcome the bill from the standpoint of the appropriation of funds for the investigation and improvement of weather predictions, still, on the other hand, the method by which it is sought to attain this great object appears to me to be very doubtful. A competition is, indeed, in itself not to be condemned, if the most competent specialists, of clear and incorruptible judgment and in independent positions, be selected as arbiters. This independence does not, however, consist in the fact, as laid down in the bill, that the three jurors in question shall not be allowed to accept any Government position, as that is quite irrelevant to the verdict, but it is much more important that they shall not be prejudiced in any way against any of the competitors. Through the provision of the bill that the judges shall not be in Government employ, the most competent specialists in America, the officials of the United States Weather Bureau, as well as those in the meteorological service of the individual States, will be excluded. Under such circumstances, it would be best for the selected universities to decline to name candidates for jurors.

Secondly, the bill prescribes that the search for the correct basis of weather forecasts shall be carried on according to the method which in my lecture I call the heuristic method.[1] Although this method, when used with all possible precaution, is in many cases admissible and may eventually lead to the desired goal, it ought, properly speaking, to be employed in the further pursuit of science only in such a manner that exact research will proceed in the standard way, following the genetic and causal methods, and be only incidentally occupied with the heuristic method. In other words, it is dangerous to limit one's self to the heuristic method; this method has in it an element of inaccuracy which up to this time has always manifested itself in the investigation of weather forecasts, and which is not to be eliminated notwithstanding the exact provisions contained in the bill for determining the verifications of the forecasts. It would require too much time for me to go deeper into this question. I will, however, point out the necessarily disagreeable consequences in which this competition will involve the bill.

There is no doubt but that, when this competition becomes known, many hundreds of persons will, year after year, send their prognostications to the three juror-colleagues for examination. Those poor jurors! However, these latter will be well paid and, therefore, they will perhaps be able to endure the frightful ordeal! But there can be no doubt that among the many hundreds who will send in their forecasts there will not be ten who, in case they are required to explain from the beginning the principles upon which their predictions are based, will not be rejected with derision or indignation by the jurors and forbidden to take part in the competition. Now, shall all of these utterly impossible principles—to the torment of the judges—nevertheless be allowed consideration in the investigation of the true physical basis of weather forecasts? Shall any and every one be permitted to submit weather predictions and his investigation of fundamental principles to the judges, instead of the principles on which they are based being first submitted to a preliminary test, and those only accepted which successfully pass that test? Does not logic demand that the process be reversed and require that the nature of the basis be first demanded, and that only those be admitted to the competition who can furnish a rational basis and not one that from the very outset is physically impossible? One should not blindly load the judges with the great burden of a strict scientific test quite gratuitously for every would-be weather prophet. The object of the whole competition is expressly announced to be the discovery of a true physical basis for weather predictions. How can this object be attained by admitting every one to the competition, even those who have not the faintest conception of such a basis? Such a proceeding is in the highest degree objectionable.

The so-called heuristic method is in itself not entirely free from uncertainty. Not that it is impossible to handle it accurately, but because this accurate manipulation is attended with very great difficulties, which even the most experienced and most accurate investigator can overcome only with great labor. To cite only one example: The bill prescribes that the forecasts of rain shall be made for any three of the following States: Massachusetts, New York, Pennsylvania, District of Columbia, Georgia, Ohio, Minnesota, Missouri, Kansas, Texas, or California. It is, therefore, left to the observer to choose which States he will take. Now, assuming the correctness of the principles on which his forecasts are based, this would imply that he can just as easily make the prediction for all the other States at the same time, whereas, the jurors can not positively determine that the forecast is based on a *correct* principle if it is to be verified in *three* States only.

Again, it is prescribed that the prediction shall extend over the six months, March–August, 1905, or one of the succeeding years, but in every case only over a half year. This is undoubtedly far too short a period for an accurate test of any fundamental principle; in order to be able to lay claim to a strict, scientifically correct, accurate trial, these predictions should be furnished and tested for a period of at least ten consecutive years. It is quite possible that a prediction for a single year may be accidentally verified, without any bearing on the question whether a correct principle was used in making the forecasts. I remember an example often cited: The editor of a calendar in Moravia had, for the ordinary weather predictions, such as are usually introduced into weather calendars, relied upon a colaborer, who, however, failed him. In his despair he seized upon a calendar for south Africa, which he happened to have, for the year just ending, and simply copied the weather predictions contained therein into his calendar for the following year. And, behold! he had predicted the weather better than all the other calendars, and he was often appealed to as to what method or principles he had used. It would be very comical in this case to speak of his discovery of a physical basis for weather forecasts for Moravia! Or would it be correct to lay down the principle that the weather in Moravia is the same as the weather shown in the calendar for the preceding year in south Africa? Whether this really happened, however, is more than doubtful. The editor of the calendar in question was the next year convinced that he owed his luck to an accidental coincidence which did not recur in the following year.

Finally, the method for determining successful predictions which, most remarkable to say, is prescribed to the jurors in the bill will certainly never lead to the desired end. Those cases must be counted as verified which are above or below the normal rainfall and to that extent agree with the predictions. But when the rain is only a trifle above or below the normal shall this be counted as a verification? On the other hand, when it is only a trifle over or under the normal is it a failure? Should an agreement with the normal be a half verification? It may certainly be predicted that by this kind of test a decided verdict for or against can not be attained.

It seems to me most unbecoming for professional men,

[1] The "heuristic" method, as the term is used by Pernter, is not the strict, logical, inductive method, that considers all the observations first, but consists in inventing or devising a method of forecasting and then endeavoring to find agreements between the forecasts and the weather that shall establish the correctness of the principles on which the forecasts are based. It is a method that can lead to the discovery of the laws of nature only under the most fortunate and unusual combination of circumstances. To assume that the earth is round and then to test this assumption by the observation of phenomena is an example of the heuristic method. To first observe many phenomena and conclude from them that the earth must be round is the strict, logical, inductive method. To accept certain principles as being well established and then deduce their necessary consequences, even though these consequences have never been observed, is the true deductive method.—*F. O. S.*

nominated by universities for appointment as jurors, to receive instructions and commands from legislators who are not professional men as to what they must do in the treatment of purely scientific questions, or as to how they must proceed in a strictly scientific investigation. These specialists will certainly make use of the most exact methods, because this is their usual habit of work; the methods recommended by the bill are not in themselves sufficiently accurate, and can not be made so except by the hands of experts and by making use of necessary modifications.

Furthermore, I am of the opinion that the discovery of the correct physical basis can never be attained by a competition of this kind. This basis will never be discovered by means of experiments in predictions, which are for the most part matters of personal judgment, but only through long continued, rigidly exact, genuine research, with the aid of physical methods, by men equipped with a complete knowledge of physical, meteorological, and mathematical sciences. This is, without doubt, one of the most difficult and complex of all the problems of physics and, therefore, it can only be by means of the devotion of the most profound erudition and many years of research, combined with occasional strokes of genius, that ultimately, if ever, it will be granted to mankind to solve the problem of weather forecasting. Work, hard and thorough work for many, many years, and not a game of chance in experimental predictions, is what is required in this matter.

The method prescribed in the bill is, therefore, already quite hopeless, because it tacitly assumes that some one now living is in possession of the correct physical principles, for it is only in this case that the bill will, by the methods that it proposes, lead to the knowledge of these principles. Ordinarily, I do not like to express myself in an apodistic manner, but in this case I do not hesitate to declare that it is absolutely sure and certain that, at the present time, no human being is in possession of the knowledge of the true physical basis for weather predictions. You will say, "This is true, but if one were only in partial possession of only one of the principles that would already be an advantage." That is true, but certainly one does not need to pay such a high price for this, for all that can be accomplished by a partial knowledge of true physical principles is now being done by the meteorological institutions; and it is certain that no one knows of a single principle of importance more than those known to the experts of these institutions, who, in their predictions, certainly make use of all principles now known, as I have already demonstrated in my lecture. It therefore seems to me certain that competition, as shown by the bill, must remain entirely fruitless.

I would, however, strongly indorse a bill authorizing the devotion of $150,000 to the prosecution of accurate, extensive investigations covering the whole subject of the improvement of weather predictions. There might be some men—let us with the present bill say three men—whom we could secure men of perfect professional education (perhaps *one*, with a sufficient number of assistants, might suffice). They should, if possible, be men of considerable reputation in meteorology, to whom the one sole duty should be assigned of investigating the true principles of weather forecasting; who should, among other things, subject the following relations to the most thorough and detailed investigation: (1.) The connection between the weather and atmospheric pressure, (2) the conditions, manner, and causes of the transition from one style of distribution of atmospheric pressure to another, from day to day, as well as for longer periods; (3) the connection of the solar and other cosmic processes with the terrestrial and especially the meteorological phenomena. The predestinate and, undoubtedly, the most suitable institution for this purpose is the United States Weather Bureau. By this means, the $150,000 will most assuredly be expended in the manner most profitable to weather forecasting and the predictions will, without doubt, make notable progress.

If, on the other hand, we follow the plan proposed by the bill, the $150,000 will certainly be saved to the treasury, since it will never be possible to award the prize to anyone. The three jurors will be uselessly tormented and disturbed, and hindered in their own scientific investigations; and they will have to be paid $10,000 without having discovered a prize winner, if the jurors are honorable, strict specialists.

I have replied to your questions technically, and with a sincere love of the truth, such as is to the scientist the only justification of his activity. Unfortunately, your views concerning this bill do not apparently agree with mine. I hope, however, that mature reflection will lead you to concur in my conclusions.

With the highest regard, I remain, very respectfully,

(Signed) J. M. PERNTER.

RELATION OF PRECIPITATION TO YIELD OF CORN.

By J. WARREN SMITH, Section Director, Weather Bureau, assisted by WILLIAM D. GIBBS, President of the New Hampshire State College.

[Summary of an article prepared for the Year Book of the U. S. Department of Agriculture, for 1903.]

All cultivators of the soil recognize the important relation between precipitation and crop yield. Johnson said in 1870, How Crops Feed, p. 216 :

> It is a well recognized fact that next to temperature the water supply is the most influential factor in the production of a crop.

Yet we believe that few people have any appreciation of the effect of an abundant water supply upon the ultimate yield of crops. Whitney says, Bulletin No. 22, Bureau of Soils, p. 63:

> On the average farm the great controlling factor in the yield of crops is not the amount of plant food in the soil, but is a physical factor, the exact nature of which is yet to be determined.

Later, on same page, he says :

> The results of these investigations also seem to indicate that the actual quantity of water a soil can furnish the plant, irrespective of the percentage of water actually present in the soil, has probably a very important influence on the yield.

It is self-evident that to have water furnished to the plants in any soil in sufficient quantities there must be an abundant supply available, either through actual rainfall or by irrigation. So that, other things being equal, the results of the investigations of the Bureau of Soils seem to agree with the results of experience, viz : Heavy rainfall, large yields; light rainfall, light yields. Moreover, in a latitude and at an elevation favorable for the production of crops, precipitation is more important than temperature in its effect upon the yield.

It was with something of this thought in mind that the writer of this article began the preparation of the accompanying diagrams. Yet he was not prepared for the remarkable confirmation of the theory, or the close relation between the yield of corn and the precipitation in certain definite short periods during the growth of the crop.

Inasmuch as the greater part of the corn produced in the United States is grown in the central part of the country we have considered only the following States : Ohio, Indiana, Illinois, Iowa, Nebraska, Kansas, Missouri, and Kentucky.

As the area of greatest corn production does not include all of Ohio, Kentucky, Kansas, or Nebraska, we probably should have considered only the western part of Ohio and Kentucky and the eastern parts of Nebraska and Kansas for both yield and rainfall. (Quite likely Kentucky should have been left out of the discussion altogether.) We were anxious, however, to include all the principal corn producing districts, and the data were more readily available by States than by counties.

It is not practicable to reproduce all the original diagrams in this article; hence, the three most important have been selected.

Fig. 1. The solid line shows the average yield of corn in bushels per acre for the States of Ohio, Indiana, Illinois, Iowa, Nebraska, Kansas, Missouri, and Kentucky, for each year from 1888 to 1903, inclusive. The dotted line indicates the average precipitation in inches for the months of June, July, and August over these States and for the respective years. The heavy horizontal line indicates the normal for the sixteen years, for both yield and rainfall. The charts in the Year Book cover only up to and including 1902, but it will be noticed that these include 1903.

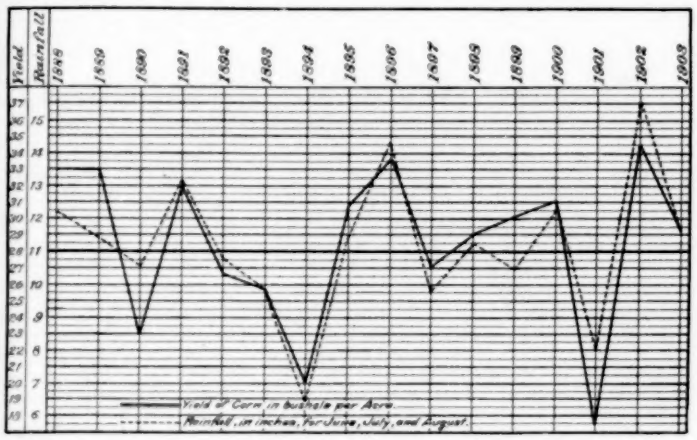

FIG. 1. Rainfall for June, July, and August, and yield of corn per acre.

Fig. 2. The solid line shows the yield of corn per acre as in fig. 1. The dotted line indicates the average precipitation, in inches, over the same States during the month of July.

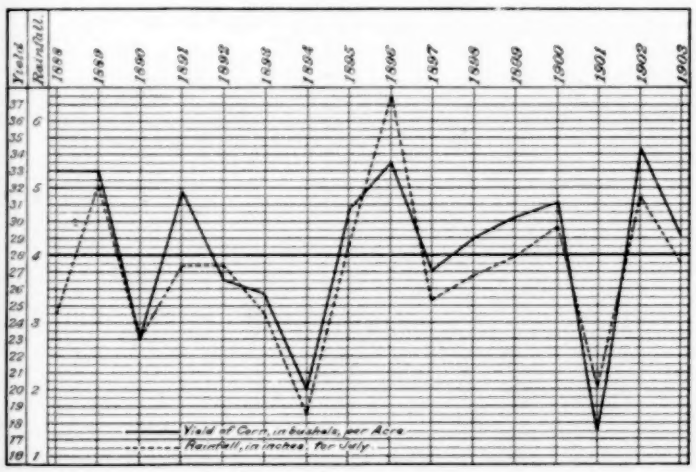

FIG. 2. Rainfall for July and yield of corn per acre.

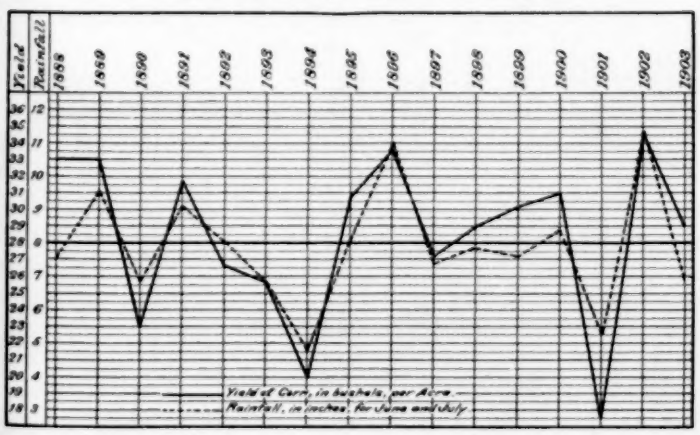

FIG. 3. Rainfall for June and July, and yield of corn per acre.

30——3

Fig. 3. The solid line shows the yield of corn per acre as in the two preceding figures. The short dash line indicates the precipitation, in inches, over the district under discussion during June and July.

Fig. 1 shows conclusively that whenever the rainfall for the summer months departs very much from the normal, the yield of corn per acre will also depart from the normal in a marked degree whenever the district considered is so extensive that effects of unusual local conditions are obliterated. Curves for each individual State do not coincide as closely as do these showing the averages for the eight States.

It is true that there are some apparent anomalies. For example, the rainfall in 1902 is much in excess of that for 1896, while the average yield per acre is only slightly in excess. An inspection of fig. 2, however, shows a very much greater rainfall in July, 1896, than in July, 1902. It will be noticed also that while the yield was the lowest on record in 1901, the precipitation for the summer was not so small as in 1894. A study of individual State yields shows that the yield was particularly low in 1894 only in the Western States, and was but little below normal in the central and eastern corn States. In 1901, on the other hand, the yield was low in every State. It was the lowest in the period under discussion in Indiana, Illinois, Kansas, Missouri, and Kentucky. The rainfall during July of 1901 was everywhere below normal, the least rainfall being in Indiana, Illinois, and Missouri, where the yields were the least. In 1890 the yield was very low, while the precipitation for the summer was but little below the normal. This anomaly is partly due to the inclusion in the computation of some areas with only a small acreage in corn. For example, the yield in Ohio was the least in sixteen years, although the rainfall for the State was about normal. The average rainfall for Ohio for the month of July, however, was considerably below the normal, while in the western counties, where the most of the corn is grown, there was a severe drought. Many stations in the western part of the State reported the least rainfall of any July on record. At Dayton, Montgomery County, the total rainfall for July, 1890, was only 0.28 inch; at Waynesville, Warren County, 0.48 inch; at North Lewisburg, Champaign County, 0.30 inch; Wauseon, Fulton County, 0.48 inch; and at Greenville, Darke County, one of the largest corn producing counties in the State, it was only 0.07 inch.

Fig. 2 shows a most striking result. It indicates that if one knows the precipitation for the month of July alone over the great corn growing district of the United States, the yield can be estimated very closely. There are anomalies to be sure, but practically all of them can be explained by knowing the June weather conditions and the distribution of the July rainfall. As to 1888, we are not sure that the statistics of yield were collected with the accuracy that has been exercised since. In 1891, when the yield for the district was considerably above the normal with the precipitation slightly below, there was a large June rainfall. There was a large yield in Nebraska and a moderately large yield in Kansas, Kentucky, and Iowa, which would increase the average yield for the district. The precipitation during July, 1896, was the largest during the period, though the yield was not so great as in 1902. An examination of the meteorological records for July, 1896, shows that excessive showers, which injured rather than benefited corn, fell in Ohio, across the northern part of the district, while damage was done by drought in southern Missouri; the yield was slightly below the normal in Missouri, and was only slightly above in Indiana and Kentucky. In 1902 the yield was the highest during the period, while the rainfall for July was less than in 1889 or 1896. The rainfall in June, 1902, however, was far above that of any other June, and with the abundant and well distributed rainfall of July produced the heavy yield.

Fig. 3 shows that if we combine the precipitation for June and July, as has been done in this chart, we have a curve of rainfall that follows the curve of yield even more closely than the July rainfall alone, as might be expected, particularly in 1891 and 1896. It will be noticed that the lowest yield occurred in 1901, when the rainfall for June and July was 2.50 inches below the normal, whereas the next lowest yield was in 1894, when the rainfall for June and July was 3.25 inches below the normal. A study of individual States shows that the yield in 1894 was particularly low only in the Western States, while it was but slightly below the normal in the Eastern States. The meteorological records show a severe drought during both summers, but in 1894 it extended later into August, while in 1901 it began somewhat earlier in June. Higher temperatures accompanied the drought in 1901, intensifying its influence and helping to force the yield lower than in 1894.

We are of the opinion that a more detailed study of the yield of corn by counties, and the distribution of the rainfall, both geographically and daily, will show an even closer relation between the yield of corn and the rainfall for a comparatively short period during the summer.

We believe also that a more complete study of this whole subject will show that there are comparatively short periods during the growth of practically every crop when favorable weather will insure a large crop and unfavorable weather will cause a small crop.

INVARIABILITY OF OUR WINTER CLIMATE.

By WM. B. STOCKMAN, District Forecaster, in charge of Division of Meteorological Records, dated June 24, 1904.

In order to comply with the request of a correspondent asking whether the winters are becoming less rigorous than formerly, it was recently necessary to compile temperature data covering a considerable period of years at a number of selected stations, so distributed as to show the general conditions obtaining over the country generally east of the Mississippi Valley. In this section only could records of the necessary length be obtained.

TABLE 1.

Station.	Average of 50 winters, 1854–55 to 1903–4.	Mean of first 25 winters, 1854–55 to 1878–79.	Departure from average of 50 winters.	Mean of second 25 winters, 1879–80 to 1903–4.	Departure from average of 50 winters.
Fort Snelling, Minn.	13.4	12.9	— 0.5	13.8	+ 0.4
Fort Leavenworth, Kans.	29.3	29.1	— 0.2	29.6	+ 0.3
New Orleans, La.	55.4	55.2	— 0.2	55.5	+ 0.1
St. Louis, Mo.	33.5	33.5	0.0	33.5	0.0
Chicago, Ill.	25.2	25.0	— 0.2	25.5	+ 0.3
Cincinnati, Ohio.	34.4	34.8	+ 0.4	34.0	— 0.4
Cleveland, Ohio.	28.2	28.2	0.0	28.2	0.0
New Bedford, Mass.	29.3	29.1	— 0.2	29.5	+ 0.2
Washington, D. C.	34.5	34.2	— 0.3	34.9	+ 0.4
Charleston, S. C.	51.2	51.1	— 0.1	51.3	+ 0.1

I believe these data and tables will be of interest to our officials and perhaps of value in enabling them to readily answer the various questions bearing on that subject so often asked by newspaper men and others.

TABLE 2.—*Mean monthly and winter temperatures.*

Year.	Fort Snelling, Minn.					Fort Leavenworth, Kans.					New Orleans, La.					St. Louis, Mo.					Chicago, Ill.					Year.
	Dec.	Jan.	Feb.	Mean	Dept.	Dec.	Jan.	Feb.	Mean	Dept.	Dec.	Jan.	Feb.	Mean	Dept.	Dec.	Jan.	Feb.	Mean	Dept.	Dec.	Jan.	Feb.	Mean	Dept.	
1854–55.	20.6	17.1	12.6	16.8	+ 3.4	34.4	28.1	38.2	33.6	+ 4.3	52.4	55.1	50.3	52.6	—2.8	35.6	32.1	28.0	31.9	—1.6	28.0	26.0	18.0	24.0	— 1.2	1854–55
1855–56.	9.5	6.1	11.7	9.1	— 4.3	23.4	10.1	24.6	19.4	— 9.9	55.1	43.0	54.8	51.0	—4.4	30.7	18.4	25.0	24.7	—8.8	22.0	13.0	17.0	17.3	— 7.9	1855–56
1856–57.	8.8	—2.5	16.4	7.6	— 5.8	22.5	12.1	33.2	22.6	— 6.7	54.2	51.6	66.3	57.4	+2.0	29.3	19.0	41.6	30.0	—3.5	18.4	10.7	30.6	19.9	— 5.3	1856–57
1857–58.	25.4	18.0	7.6	17.0	+ 3.6	39.2	40.1	25.6	35.0	+ 5.7	58.5	60.4	56.5	58.5	+3.1	40.2	40.2	27.0	35.8	+2.3	31.4	33.0	19.0	27.8	+ 2.6	1857–58
1858–59.	12.0	7.8	14.2	11.3	— 2.1	31.9	32.6	32.5	32.3	+ 3.0	62.0	53.9	63.7	59.9	+4.5	38.0	33.1	37.2	36.1	+2.6	28.0	27.0	29.0	28.0	+ 2.8	1858–59
1859–60.	0.5	9.8	14.2	8.2	— 5.2	18.9	29.6	35.2	27.9	— 1.4	53.2	55.1	59.6	56.0	+0.6	34.2	32.7	36.8	34.6	+1.1	15.7	18.1	26.8	20.2	— 5.0	1859–60
1860–61.	10.0	7.7	15.5	11.1	— 2.3	26.2	22.7	33.7	27.5	— 1.8	55.4	54.0	62.2	57.2	+1.8	31.3	32.4	40.4	34.7	+1.2	20.5	21.9	29.4	23.9	— 1.3	1860–61
1861–62.	15.9	2.1	1.9	6.6	— 6.8	35.4	20.2	24.1	26.6	— 2.7	.....	.....	.....	.....	.....	39.6	29.7	30.2	33.2	—0.3	28.4	18.2	20.9	22.5	— 2.7	1861–62
1862–63.	17.4	14.4	11.7	14.5	+ 1.1	41.0	34.9	29.7	35.2	+ 5.9	.....	.....	.....	.....	.....	41.2	37.4	35.6	38.1	+4.6	30.3	33.5	20.6	28.1	+ 2.9	1862–63
1863–64.	17.9	11.4	20.0	16.4	+ 3.0	28.8	25.0	34.3	29.4	+ 0.1	.....	.....	.....	.....	.....	35.7	29.1	37.8	34.2	+0.7	26.3	16.2	23.6	22.0	— 3.2	1863–64
1864–65.	6.4	9.7	19.1	11.7	— 1.7	20.2	25.4	34.3	26.6	— 2.7	.....	.....	.....	.....	.....	30.0	28.4	37.8	32.1	—1.4	17.8	17.2	26.0	20.3	— 4.9	1864–65
1865–66.	7.1	8.2	5.9	7.1	— 6.3	22.6	26.3	29.0	26.0	— 3.3	.....	.....	.....	.....	.....	31.2	32.6	33.2	32.3	—1.2	20.2	17.7	17.9	18.6	— 6.6	1865–66
1866–67.	10.0	13.2	18.0	13.7	+ 0.3	28.1	21.0	32.3	27.1	— 2.2	.....	.....	.....	.....	.....	33.7	25.9	39.7	33.1	—0.4	25.8	19.9	30.8	25.5	+ 0.3	1866–67
1867–68.	16.1	4.2	13.9	11.4	— 2.0	34.6	19.6	32.2	28.8	— 0.5	.....	.....	.....	.....	.....	35.7	25.8	34.7	32.1	—1.4	28.8	17.9	24.7	23.8	— 1.4	1867–68
1868–69.	15.5	18.2	19.4	17.7	+ 4.3	26.4	33.8	32.9	31.0	+ 1.7	.....	.....	.....	.....	.....	28.9	38.7	37.1	34.9	+1.4	22.6	31.2	29.3	27.7	+ 2.5	1868–69
1869–70.	19.5	12.6	17.0	16.4	+ 3.0	26.4	29.1	35.1	30.2	+ 0.9	49.0	54.6	54.8	52.8	—2.6	33.1	33.6	36.1	34.3	+0.8	28.6	25.9	27.5	27.3	+ 2.1	1869–70
1870–71.	19.6	13.1	20.2	17.6	+ 4.2	28.6	30.4	38.2	32.4	+ 3.1	*47.8	53.6	60.5	54.0	—1.4	31.0	*37.7	39.9	36.2	+2.7	27.1	30.9	30.2	29.4	+ 4.2	1870–71
1871–72.	7.7	13.8	18.4	13.3	— 0.1	24.1	24.7	30.9	26.6	— 2.7	55.5	48.1	55.3	53.0	—2.4	30.2	28.3	32.2	30.2	—3.3	20.0	23.0	25.5	22.8	— 2.4	1871–72
1872–73.	3.9	4.4	11.0	6.4	— 7.0	21.0	18.7	29.7	23.1	— 6.2	51.1	49.3	60.3	53.6	—1.8	25.3	25.7	33.6	28.2	—5.3	19.0	20.4	24.1	21.2	— 4.0	1872–73
1873–74.	17.2	12.2	13.0	14.1	+ 0.7	31.5	28.5	28.9	29.6	+ 0.3	56.5	55.8	58.9	57.1	+1.7	37.1	35.2	36.1	36.1	+2.6	32.0	28.9	31.4	30.8	+ 5.6	1873–74
1874–75.	17.7	—4.4	—2.1	3.7	— 9.7	32.6	15.1	20.5	22.7	— 6.6	58.6	54.3	55.8	56.2	+0.8	37.5	23.9	26.0	29.1	—4.4	33.5	17.9	14.7	22.0	— 3.2	1874–75
1875–76.	25.4	17.1	11.7	18.1	+ 4.7	39.9	35.9	38.3	38.0	+ 8.7	61.6	60.3	59.0	60.3	+4.9	43.4	41.5	40.8	41.9	+8.4	36.8	33.0	31.8	33.9	+ 8.7	1875–76
1876–77.	6.6	6.9	30.8	14.8	+ 1.4	23.3	23.9	39.5	28.9	— 0.4	47.9	53.5	55.6	52.3	—3.1	24.9	31.3	41.5	32.6	—0.9	20.0	21.9	36.4	26.1	+ 0.9	1876–77
1877–78.	31.5	20.1	30.7	27.4	+14.0	44.1	33.9	40.0	39.3	+10.0	55.6	50.9	55.4	54.0	—1.4	47.9	35.8	41.1	41.6	+8.1	42.8	31.2	35.7	36.6	+11.4	1877–78
1878–79.	15.4	11.6	8.2	11.7	— 1.7	23.2	23.6	32.8	26.5	— 2.8	50.8	53.1	55.8	53.2	—2.2	27.1	28.3	33.9	29.8	—3.7	23.7	21.4	27.4	24.2	— 1.0	1878–79
1879–80.	8.0	22.4	19.4	16.6	+ 3.2	26.4	41.4	37.9	35.2	+ 5.9	59.5	63.0	60.4	61.0	+5.6	32.3	45.7	39.2	39.1	+5.6	30.3	40.1	34.6	35.0	+ 9.8	1879–80
1880–81.	10.4	5.0	4.2	6.5	— 6.9	25.6	20.5	25.1	23.7	— 5.6	52.9	50.3	56.0	53.1	—2.3	27.1	21.7	30.3	26.4	—7.1	23.0	19.5	24.7	22.4	— 2.8	1880–81
1881–82.	26.6	15.3	26.3	22.7	+ 9.3	40.2	32.4	42.0	38.2	+ 8.9	59.2	62.4	62.5	61.4	+6.0	40.8	32.1	43.9	38.9	+5.4	37.1	28.3	38.2	34.5	+ 9.3	1881–82
1882–83.	11.6	—2.8	8.9	5.9	— 7.5	31.6	19.4	27.9	26.3	— 3.0	54.0	56.8	62.9	57.9	+2.5	32.3	23.2	31.3	28.9	—4.6	20.0	16.3	23.0	19.8	— 5.4	1882–83
1883–84.	15.8	3.7	8.0	9.2	— 4.2	35.1	21.1	27.9	28.0	— 1.3	60.3	47.1	60.7	56.0	+0.6	39.5	25.8	35.5	33.6	+0.1	30.1	19.2	27.7	25.7	+ 0.5	1883–84
1884–85.	8.9	—0.8	4.6	4.2	— 9.2	24.1	19.0	21.6	21.6	— 7.7	58.7	52.1	53.1	54.6	—0.8	32.8	26.0	27.0	28.6	—4.9	28.4	18.3	16.1	20.9	— 4.3	1884–85
1885–86.	21.3	3.5	14.5	13.1	— 0.3	32.8	14.4	30.2	25.8	— 3.5	53.1	45.5	53.2	50.6	—4.8	38.9	24.8	35.1	32.9	—0.6	31.1	21.4	28.1	26.9	+ 1.7	1885–86
1886–87.	7.3	—1.1	8.4	4.9	— 8.5	23.7	20.7	28.9	24.4	— 4.9	51.6	51.4	65.2	56.1	+0.7	29.8	30.8	40.6	33.7	+0.2	25.0	17.3	27.1	23.1	— 2.1	1886–87
1887–88.	16.1	—2.3	10.5	8.1	— 5.3	27.2	16.3	31.4	25.0	— 4.3	52.9	55.6	58.6	55.7	+0.3	31.5	24.3	32.2	29.3	—4.2	28.1	15.1	23.0	22.1	— 3.1	1887–88
1888–89.	25.4	18.3	5.9	16.5	+ 3.1	35.8	29.8	27.5	31.0	+ 1.7	53.8	53.4	53.4	53.5	—1.9	38.2	34.8	31.4	34.8	+1.3	32.2	29.0	19.9	27.0	+ 1.8	1888–89
1889–90.	29.1	10.9	19.9	20.0	+ 6.6	45.3	28.1	32.3	35.2	+ 5.9	64.3	65.1	64.0	64.5	+9.1	49.8	39.2	40.2	43.1	+9.6	40.6	30.8	32.4	34.6	+ 9.4	1889–90
1890–91.	21.7	19.6	8.7	16.7	+ 3.3	37.0	33.2	29.8	33.3	+ 4.0	56.4	53.2	62.6	57.4	+2.0	37.6	36.6	35.9	36.7	+3.2	30.6	30.2	28.6	29.8	+ 4.6	1890–91
1891–92.	29.4	10.8	23.0	21.1	+ 7.7	39.3	23.9	36.4	33.2	+ 3.9	55.9	49.3	60.6	55.3	—0.1	42.8	25.9	40.0	36.2	+2.7	35.4	19.5	30.2	28.4	+ 3.2	1891–92
1892–93.	14.8	3.2	9.1	9.0	— 4.4	26.0	21.8	26.6	24.8	— 4.5	55.8	50.2	*61.2	55.7	+0.3	33.0	24.8	30.8	29.5	—4.0	23.4	12.0	21.5	19.0	— 6.2	1892–93
1893–94.	12.4	10.2	14.2	12.3	— 1.1	35.4	29.6	27.2	30.7	+ 1.4	58.4	58.0	54.9	57.1	+1.7	36.4	35.5	32.4	34.8	+1.3	25.4	27.5	23.0	25.3	+ 0.1	1893–94
1894–95.	27.0	6.0	10.7	14.6	+ 1.2	37.8	24.0	24.9	28.9	— 0.4	57.8	52.2	45.0	51.7	—3.7	38.8	26.2	25.1	30.0	—3.5	32.4	17.6	17.0	22.3	— 2.9	1894–95
1895–96.	21.1	15.6	20.8	19.2	+ 5.8	32.6	31.4	35.8	33.3	+ 4.0	53.8	52.2	56.2	54.1	—1.3	37.0	35.0	36.8	36.3	+2.8	29.6	27.0	26.6	27.7	+ 2.5	1895–96
1896–97.	23.3	9.4	18.6	17.1	+ 3.7	40.4	27.4	32.9	33.6	+ 4.3	54.6	51.1	58.0	54.6	—0.8	40.8	30.6	36.8	36.1	+2.6	32.9	21.8	28.6	27.8	+ 2.6	1896–97
1897–98.	15.4	22.6	20.8	19.6	+ 6.2	28.0	32.4	35.4	31.9	+ 2.6	57.0	58.6	56.6	57.4	+2.0	32.8	37.3	38.4	36.2	+2.7	25.0	28.6	27.6	27.1	+ 1.9	1897–98
1898–99.	13.3	13.7	7.6	11.5	— 1.9	27.4	30.9	19.4	25.9	— 3.4	50.8	53.2	49.4	51.1	—4.3	32.6	32.6	24.1	29.8	—3.7	24.3	23.0	17.9	21.7	— 3.5	1898–99
1899–00.	21.2	21.1	8.4	16.9	+ 3.5	30.2	34.6	25.2	30.0	+ 0.7	54.6	52.2	53.4	53.4	—2.0	33.0	37.4	29.8	33.4	—0.1	27.2	28.7	20.1	25.3	+ 0.1	1899–00
1900–01.	21.7	16.2	12.6	16.8	+ 3.4	35.8	34.7	26.7	32.4	+ 3.1	55.6	55.6	53.4	54.9	—0.5	38.0	37.2	31.0	35.4	+1.9	30.0	26.0	17.0	24.3	— 0.9	1900–01
1901–02.	15.8	18.5	17.8	17.4	+ 4.0	28.4	30.8	23.4	27.5	— 1.8	52.0	53.4	50.2	51.9	—3.5	30.2	32.4	26.4	29.7	—3.8	24.0	25.2	20.8	23.3	— 1.9	1901–02
1902–03.	15.9	15.0	15.0	15.3	+ 1.9	29.0	31.6	28.5	29.7	+ 0.4	54.0	52.0	56.4	54.1	—1.3	34.0	33.7	33.6	33.8	+0.3	26.5	24.0	25.0	25.2	0.0	1902–03
1903–04.	12.9	7.6	6.2	8.9	— 4.5	31.9	26.8	29.0	29.2	— 0.1	52.2	51.4	60.3	54.6	—0.8	29.8	27.8	30.8	29.5	—4.0	20.0	17.7	17.2	18.3	— 6.9	1903–04
Av'rage	.....	.....	.....	13.4	.....	.....	.....	.....	29.3	.....	.....	.....	.....	55.4	.....	.....	.....	.....	33.5	.....	.....	.....	.....	25.2	.....	
Mean[1].	.....	.....	.....	12.9	— 0.5	.....	.....	.....	29.1	— 0.2	.....	.....	.....	55.2	—0.2	.....	.....	.....	33.5	0.0	.....	.....	.....	25.0	— 0.2	
Mean[2].	.....	.....	.....	13.8	+ 0.4	.....	.....	.....	29.6	+ 0.3	.....	.....	.....	55.5	+0.1	.....	.....	.....	33.5	0.0	.....	.....	.....	25.5	+ 0.3	

The stations selected were Fort Snelling, Minn.; Fort Leavenworth, Kans.; New Orleans, La.; St. Louis, Mo.; Chicago, Ill.; Cincinnati and Cleveland, Ohio; New Bedford, Mass.; Washington, D. C., and Charleston, S. C.

The data for Fort Snelling and Fort Leavenworth are not as satisfactory as could be desired, for to fill breaks in the continuity of these records it was found necessary to use the figures from contiguous stations having the required data, which in the case of Fort Snelling were Fort Ripley, Minn., from January, 1858, to December, 1865, inclusive, and St. Paul, Minn., from December, 1892, to February, 1904, inclusive; and for Fort Leavenworth, Kans., Leavenworth City, Kans., from December, 1871, to February, 1893, inclusive, and Kansas City, Mo., from December, 1893, to February, 1904, inclusive.

From January, 1860, to December, 1861, inclusive, the values for Washington, D. C., are those of Georgetown (west Washington). No data were found for the winters of 1861-62 to 1868-69, inclusive, at New Orleans, La.; nor for 1854-55 at Cleveland, Ohio. The data for Forts Snelling and Ripley, Minn., were taken from U. S. Army post hospital records, and St. Paul, Minn., from Weather Bureau records; Fort Leavenworth, Kans., from post hospital, and Leavenworth, Kans., and Kansas City, Mo., from Weather Bureau records; New Bedford, Mass., from voluntary records throughout the series. The figures for the remaining stations were obtained from the records of voluntary observers cooperating with the Smithsonian Institution until the beginning of Weather Bureau data November 1, 1870, at New Orleans, La., Cincinnati and Cleveland, Ohio, and Washington, D. C.; January, 1871, at St. Louis, Mo., and Charleston, S. C.; and December, 1871, at Chicago, Ill.

The kind of exposure given Weather Bureau thermometers is set forth in Table 4. The character of exposure of thermometers used by U. S. Army post surgeons, and by voluntary observers is not known, but it is assumed to be in the open and a few feet above sod.

As overlapping data from voluntary and Weather Bureau observers were not available for the majority of stations, it was not deemed advisable to attempt to reduce and harmonize the data from the several observers to a standard for each station.

Table 3 gives all the overlapping data from the stations considered on file at the Central Office.

The means of the winter months, December, January, and February, were added together and divided by three to establish a mean for each winter, and the average of the winters for the 50-year period, 1854–55 to 1903–4, inclusive, determined. Each winter was then compared with the 50-year average and the departure ascertained.

From a study of the departures given during the last past fifty years it will be seen that the contention that the winters of recent years are less rigorous than those of former years, at least so far as temperature is concerned, is not well founded, for at Cleveland, Ohio, and St. Louis, Mo., the mean of the first and second 25-year periods was the same as the 50-year average; at Cincinnati the second period averaged 0.8° lower than

TABLE 2.—*Mean monthly and winter temperatures.*—Continued.

Year.	Cincinnati, Ohio.					Cleveland, Ohio.					New Bedford, Mass.					Washington, D. C.					Charleston, S. C.					Year.
	Dec.	Jan.	Feb.	Mean	Dept.	Dec.	Jan.	Feb.	Mean	Dept.	Dec.	Jan.	Feb.	Mean	Dept.	Dec.	Jan.	Feb.	Mean	Dept.	Dec.	Jan.	Feb.	Mean	Dept.	
1854-55.	34.6	34.9	29.0	32.8	— 1.6	.....	.....	.....	.....	.....	28.3	32.0	23.5	27.9	—1.4	32.4	34.8	26.8	31.3	—3.2	48.3	51.1	47.0	48.8	— 2.4	1854-55
1855-56.	35.0	20.8	26.7	27.5	— 6.9	29.6	15.2	18.4	21.1	— 7.1	34.2	20.9	22.6	25.9	—3.4	36.8	21.3	26.8	28.3	—6.2	53.2	39.4	47.6	46.7	— 4.5	1855-56
1856-57.	29.7	21.2	45.4	32.1	— 2.3	24.5	14.5	37.4	25.5	— 2.7	27.6	18.6	33.1	26.4	—2.9	31.5	21.5	41.8	31.6	—2.9	49.1	41.7	58.4	49.7	— 1.5	1856-57
1857-58.	39.7	40.8	29.1	36.5	+ 2.1	36.1	35.4	22.5	31.3	+ 3.1	36.0	34.1	25.0	31.7	+2.4	34.8	39.8	30.8	35.1	+0.6	57.7	55.8	47.9	53.8	+ 2.6	1857-58
1858-59.	44.9	36.1	40.6	40.5	+ 6.1	34.9	29.3	31.2	31.8	+ 3.6	32.5	29.0	31.6	31.0	+1.7	39.6	36.0	39.2	38.3	+3.8	57.8	50.8	55.7	54.8	+ 3.6	1858-59
1859-60.	28.6	36.2	36.8	33.9	— 0.5	25.2	28.0	29.4	27.5	— 0.7	29.3	30.5	28.3	29.4	+0.1	33.5	35.1	35.4	34.7	+0.2	52.9	51.7	55.2	53.3	+ 2.1	1859-60
1860-61.	32.1	34.2	40.8	35.7	+ 1.3	27.3	27.2	34.4	29.6	+ 1.4	29.7	26.6	33.8	30.0	+0.7	34.3	33.7	36.3	34.8	+0.3	47.3	51.3	54.9	51.2	0.0	1860-61
1861-62.	40.4	35.2	34.6	36.7	+ 2.3	36.9	27.5	27.2	30.5	+ 2.3	33.6	29.0	28.2	30.3	+1.0	41.5	35.0	35.8	37.4	+2.9	51.9	53.3	54.6	53.3	+ 2.1	1861-62
1862-63.	40.0	38.4	38.6	39.0	+ 4.6	35.5	31.8	29.1	32.1	+ 3.9	32.7	36.4	31.2	33.4	+4.1	36.3	37.2	35.2	36.2	+1.7	48.0	51.2	57.3	52.2	+ 1.0	1862-63
1863-64.	38.6	39.4	36.0	35.0	+ 0.6	34.8	27.6	31.0	31.1	+ 2.9	31.7	30.0	32.2	31.3	+2.0	35.3	33.4	35.9	34.9	+0.4	48.3	54.0	56.3	52.9	+ 1.7	1863-64
1864-65.	33.6	26.9	37.0	32.5	— 1.9	29.0	22.0	27.9	26.3	— 1.9	32.9	23.1	29.0	28.3	—1.0	35.1	27.8	32.7	31.9	—2.6	50.4	45.3	50.7	48.8	— 2.4	1864-65
1865-66.	38.1	33.6	34.2	35.3	+ 0.9	32.4	26.3	27.6	28.8	+ 0.6	35.7	25.9	29.3	30.3	+1.0	37.7	31.3	35.0	34.7	+0.2	57.9	50.9	52.5	53.8	+ 2.6	1865-66
1866-67.	32.3	25.6	41.8	33.2	— 1.2	27.1	20.6	34.7	27.5	— 0.7	31.4	22.0	34.8	29.4	+0.1	33.3	24.4	39.0	32.2	—2.3	48.9	46.3	58.0	51.1	— 0.1	1866-67
1867-68.	35.2	29.7	33.2	32.7	— 1.7	28.4	21.3	23.7	24.5	— 3.7	26.7	25.0	23.2	25.0	—4.3	31.8	29.3	27.2	29.4	—5.1	54.0	50.2	48.4	50.7	— 0.5	1867-68
1868-69.	31.0	38.4	39.0	36.1	+ 1.7	25.9	32.8	30.4	29.7	+ 1.5	28.2	32.2	32.1	30.8	+1.5	31.0	38.1	38.4	35.8	+1.3	47.2	54.2	55.0	52.1	+ 0.9	1868-69
1869-70.	36.4	34.5	33.0	34.6	+ 0.2	32.0	29.1	26.2	29.1	+ 0.9	32.5	35.1	28.7	32.1	+2.8	37.1	39.3	34.6	37.0	+2.5	54.2	53.7	51.3	53.1	+ 1.9	1869-70
1870-71.	*30.9	36.8	39.3	35.7	+ 1.3	29.8	30.2	30.2	30.1	+ 1.9	31.7	26.3	27.9	28.6	—0.7	*34.0	32.6	35.9	34.2	—0.3	48.8	*50.1	54.7	51.2	0.0	1870-71
1871-72.	32.6	30.5	33.6	32.2	— 2.2	25.3	24.7	25.6	25.2	— 3.0	30.1	26.4	27.8	28.1	—1.2	32.1	31.7	33.7	32.5	—2.0	48.6	45.2	48.2	47.3	— 3.9	1871-72
1872-73.	29.1	30.8	35.5	31.8	— 2.6	21.9	23.2	25.9	23.7	— 4.5	23.8	27.0	26.3	25.7	—3.6	30.3	30.9	34.8	32.0	—2.5	45.1	47.4	53.3	48.6	— 2.6	1872-73
1873-74.	40.4	37.7	37.7	38.6	+ 4.2	36.3	32.8	31.1	33.4	+ 5.2	33.0	32.3	27.9	31.1	+1.8	40.5	40.3	37.2	39.3	+4.8	50.7	49.6	50.8	50.4	— 0.8	1873-74
1874-75.	40.7	26.5	27.1	31.4	— 3.0	31.4	17.3	15.5	21.4	— 6.8	31.2	21.6	21.8	24.9	—4.4	39.2	29.5	28.8	32.5	—2.0	52.2	46.8	49.1	49.4	— 1.8	1874-75
1875-76.	43.6	42.1	39.7	41.8	+ 7.4	35.8	35.0	30.2	33.7	+ 5.5	30.5	31.4	28.9	30.3	+1.0	36.8	40.8	36.7	38.1	+3.6	53.4	55.4	54.2	54.3	+ 3.1	1875-76
1876-77.	25.2	30.9	41.0	32.4	— 2.0	19.8	23.0	32.9	25.2	— 3.0	23 9	24.9	32.5	27.1	—2.2	26.5	29.4	39.4	31.8	—2.7	43.4	50.7	50.5	48.2	— 3.0	1876-77
1877-78.	47.4	36.0	40.9	41.4	+ 7.0	40.4	29.6	30.9	33.6	+ 5.4	36.6	29.6	31.2	32.5	+3.2	41.8	33.5	39.8	38.4	+3.9	53.5	49.7	51.6	51.6	+ 0.4	1877-78
1878-79.	31.2	30.4	33.6	31.7	— 2.7	24.9	23.0	23.6	23.8	— 4.4	30.4	24.8	25.5	26.9	—2.4	33.3	30.8	31.6	31.9	—2.6	48.6	49.6	49.3	49.2	— 2.0	1878-79
1879-80.	41.2	48.6	42.6	44.1	+ 9.7	33.1	39.5	34.1	35.6	+ 7.4	35.4	36.8	32.9	35.0	+5.7	41.1	41.9	40.8	41.3	+6.8	57.9	58.3	56.4	57.5	+ 6.3	1879-80
1880-81.	30.6	30.1	36.2	32.3	— 2.1	22.9	20.5	25.3	22.9	— 5.3	27.5	23.4	28.2	26.4	—2.9	29.0	27.6	32.8	29.8	—4.7	48.6	46.8	51.9	49.1	— 2.1	1880-81
1881-82.	43.6	37.5	46.5	42.5	+ 8.1	37.7	28.3	37.0	34.3	+ 6.1	38.3	28.0	31.3	32.5	+3.2	41.7	33.2	40.4	38.4	+3.9	55.5	55.1	57.3	56.0	+ 4.8	1881-82
1882-83.	34.9	30.9	38.3	34.7	+ 0.3	27.3	22.0	27.5	25.6	— 2.6	30.0	25.6	28.7	28.1	—1.2	34.1	29.6	37.5	33.7	—0.8	48.5	51.4	57.0	52.3	+ 1.1	1882-83
1883-84.	39.0	26.7	41.2	35.6	+ 1.2	32.2	19.3	29.6	27.0	— 1.2	22.0	26.1	33.1	27.1	—2.2	36.9	29.4	40.9	35.7	+1.2	56.0	46.6	58.7	53.8	+ 2.6	1883-84
1884-85.	36.1	26.1	23.2	28.5	— 5.9	30.0	20.9	16.4	25.8	— 2.4	33.4	27.5	20.4	27.1	—2.2	36.0	32.9	26.9	31.9	—2.6	53.7	50.7	47.5	50.6	— 0.6	1884-85
1885-86.	35.0	25.4	30.1	30.2	— 4.2	31.5	23.1	25.4	26.7	— 1.5	32.9	27.2	26.7	28.9	—0.4	37.5	28.9	32.1	32.8	—1.7	50.4	42.8	47.6	46.9	— 4.3	1885-86
1886-87.	28.7	29.6	39.3	32.5	— 1.9	25.3	24.9	31.6	27.3	— 0.9	29.9	26.7	29.4	28.7	—0.6	30.7	32.9	38.9	34.2	—0.3	48.4	45.6	56.7	50.2	— 1.0	1886-87
1887-88.	34.7	29.3	34.9	33.0	— 1.4	31.6	22.3	27.8	27.2	— 1.0	32.2	19.7	27.9	26.6	—2.7	37.2	29.2	35.7	34.0	—0.5	51.0	51.0	54.0	52.0	+ 0.8	1887-88
1888-89.	37.0	37.2	30.3	34.8	+ 0.4	33.8	32.6	23.2	29.9	+ 1.7	34.4	33.7	25.2	31.1	+1.8	37.5	39.2	31.1	35.9	+1.4	49.2	51.6	47.4	49.4	— 1.8	1888-89
1889-90.	48.2	41.5	43.1	44.3	+ 9.9	42.0	37.0	36.3	38.4	+10.2	37.7	34.6	33.5	35.3	+6.0	45.6	43.8	43.4	44.3	+9.8	60.0	59.3	60.6	60.0	+ 8.8	1889-90
1890-91.	35.8	36.2	40.0	37.3	+ 2.9	30.0	31.3	34.2	31.8	+ 3.6	27.2	30.8	32.6	30.2	+0.9	34.2	37.4	41.4	37.7	+3.2	51.4	50.5	58.4	53.4	+ 2.2	1890-91
1891-92.	42.0	26.0	38.8	35.6	+ 1.2	39.0	23.6	31.6	31.4	+ 3.2	38.8	29.6	29.4	32.6	+3.3	43.2	31.6	37.0	37.3	+2.8	55.2	47.8	53.0	52.0	+ 0.8	1891-92
1892-93.	31.6	21.2	34.0	28.9	— 5.5	28.6	17.6	26 3	24.2	— 4.0	28.5	20.4	26.6	25.2	—4.1	33.2	24.6	35.1	31.0	—3.5	52.3	43.4	55.7	50.5	— 0.7	1892-93
1893-94.	36.4	37.7	32.9	35.7	+ 1.3	30.9	32.5	26.2	29.9	+ 1.7	31.5	30.1	25.8	29.1	—0.2	38.3	37.8	35.2	37.1	+2.6	53.6	52.8	52.8	53.1	+ 1.9	1893-94
1894-95.	37.5	26.6	23.8	29.3	— 5.1	34.2	22.4	19.8	25.5	— 2.7	32.0	28.2	23.8	28.0	—1.3	37.4	31.6	26.2	31.7	—2.8	52.4	49.0	41.1	47.5	— 3.7	1894-95
1895-96.	37.3	33.6	35.0	35.3	+ 0.9	33.2	27.6	27.7	29.5	+ 1.3	35.2	25.5	28.8	29.8	+0.5	38.8	33.3	36.7	36.3	+1.8	50.9	48.2	52.4	50.5	— 0.7	1895-96
1896-97.	38.1	29.0	36.4	34.5	+ 0.1	32.6	24.0	29.6	28.7	+ 0.5	29.1	27.4	30.0	28.8	—0.5	35.6	31.0	36.6	34.4	—0.1	49.5	47.4	55.0	50.6	— 0.6	1896-97
1897-98.	36.3	37.2	34.9	36.1	+ 1.7	31.6	31.6	28.3	30.5	+ 2.3	35.1	30.3	33.0	32.8	+3.5	38.1	36.6	35.0	36.6	+2.1	54.0	54.9	50.1	53.0	+ 1.8	1897-98
1898-99.	32.2	32.3	24.6	29.7	— 4.7	28.9	26.4	21.2	25.5	— 2.7	31.8	29.8	25.1	28.9	—0.4	35.6	33.4	27.4	32.1	—2.4	51.2	49.9	49.2	50.1	— 1.1	1898-99
1899-00.	33.2	35.4	29.9	32.8	— 1.6	30.8	30.1	23.8	28.2	0.0	35.8	32.6	30.8	33.1	+3.8	36.2	35.2	33.7	35.0	+0.5	51.3	49.9	49.1	50.1	— 1.1	1899-00
1900-01.	35.4	33.2	27.2	31.9	— 2.5	31.8	28.3	19.5	26.5	— 1.7	33.5	29.8	25.2	29.5	+0.2	36.5	34.4	29.8	33.6	—0.9	50.9	49.9	47.5	49.4	— 1.8	1900-01
1901-02.	31.0	31.5	25.1	29.2	— 5.2	28.8	26.2	21.0	25.1	— 3.1	33.6	27.7	28.6	30.0	+0.7	34.8	31.8	29.8	32.1	—2.4	48.6	47.2	44.4	46.7	— 4.5	1901-02
1902-03.	33.0	31.1	34.6	32.9	— 1.5	28.8	26.0	28.4	27.7	— 0.5	29.1	28.8	30.6	29.5	+0.2	34.4	33.4	37.4	35.1	+0.6	52.4	48.5	53.8	51.6	+ 0.4	1902-03
1903-04.	27.6	27.0	28.9	27.8	— 6.6	23.8	19.7	18.7	20.7	— 7.5	27.0	21.8	22.0	23.6	—5.7	32.2	27.5	28.4	29.4	—5.1	45.8	45.2	49.4	46.8	— 4.4	1903-04
Av'rage	.....	.....	.....	34.4	.....	.....	.....	.....	28.2	.....	.....	.....	.....	29.3	.....	.....	.....	.....	34.5	.....	.....	.....	.....	51.2	.....	
Mean [1].	.....	.....	.....	34.8	+ 0.4	.....	.....	.....	28.2	0.0	.....	.....	.....	29.1	—0.2	.....	.....	.....	34.2	—0.3	.....	.....	.....	51.1	— 0.1	
Mean [2].	.....	.....	.....	34.0	— 0.4	.....	.....	.....	28.2	0.0	.....	.....	.....	29.5	+0.2	.....	.....	.....	34.9	+0.4	.....	.....	.....	51.3	+ 0.1	

* Beginning of Weather Bureau (Signal Service) record. [1] First twenty-five years. [2] Second twenty-five years.

the first period, while at the other stations the mean of the second 25-year period was but a few tenths degree above the 50-year average.

TABLE 3.—*Overlapping or simultaneous records.*

Year.	Fort Snelling, Minn.				Fort Ripley, Minn.				
	Dec.	Jan.	Feb.	Mean.	Dec.	Jan.	Feb.	Mean.	Difference.
1854–55	20.6	17.1	12.6	16.8	18.2	8.4	8.2	11.6	—5.2
1855–56	9.5	6.1	11.7	9.1	5.0	— 1.5	9.0	4.2	—4.9
1856–57	8.8	— 2.5	16.4	7.6	5.1	— 6.5	11.2	3.3	—4.3
Mean				11.2				6.4	—4.8
	Fort Snelling, Minn.				St. Paul, Minn.†				
1867–68	16.1	4.2	13.9	11.4	15.2	4.4	12.7	10.8	—0.6
1868–69	15.5	18.2	19.4	17.7	16.3	19.0	18.7	18.0	+0.3
1869–70	19.5	12.6	17.0	16.4	20.4	12.2	17.1	16.6	+0.2
1870–71	19.6	13.1	20.2	17.6	19.4	13.4	20.7	17.8	+0.2
1871–72	7.7	13.8	18.4	13.3	8.8	14.2	19.6	14.2	+0.9
1872–73	3.9	4.4	11.0	6.4	5.8	6.0	13.3	8.4	+2.0
Mean				13.8				14.3	+0.5
1882–83	11.6	— 2.8	8.9	5.9	16.0	1.1	12.1	9.7	+3.5
1883–84	15.8	3.7	8.0	9.2	19.8	7.9	13.3	13.7	+4.5
1884–85	8.9	— 0.8	4.6	4.2	14.8	4.6	9.9	9.8	+5.6
1885–86	21.3	3.5	14.5	13.1	21.1	4.1	15.0	13.4	+0.3
1886–87	7.3	— 1.1	8.4	4.9	8.4	1.0	9.7	6.4	+1.5
1887–88	16.1	— 2.3	10.5	8.1	17.1	— 0.9	13.4	9.5	+1.4
1888–89	25.4	18.3	5.9	16.5	24.8	20.2	10.2	18.4	+1.9
1889–90	29.1	10.9	19.9	20.0	28.6	9.9	18.5	19.0	—1.0
1890–91	21.7	19.6	8.7	16.7	24.0	21.2	11.2	18.8	+2.1
1891–92	29.4	10.8	23.0	21.1	27.3	10.0	20.8	19.4	—1.7
Mean				12.0				13.8	+1.8
	Fort Leavenworth, Kans.				Leavenworth, Kans.				
1866–67	28.1	21.0	32.3	27.1	27.6	19.5	31.8	26.3	—0.8
1867–68	34.6	19.6	32.2	28.8	33.3	17.9	30.0	27.1	—1.7
1868–69	26.4	33.8	32.9	31.0	22.6	29.7	30.3	27.5	—3.5
1869–70	26.4	29.1	35.1	30.2	28.2	25.6	32.1	28.6	—1.6
1870–71	28.6	30.4	38.1	32.4	28.0	27.5	33.5	29.7	—2.7
Mean				29.9				27.8	—2.1
	Leavenworth, Kans.				Kansas City, Mo.				
1888–89	33.8	29.8	27.5	31.0	35.9	31.2	28.5	31.9	+0.9
1889–90	43.3	28.1	32.3	35.2	46.4	30.2	34.0	36.9	+1.7
1890–91	37.0	33.2	29.8	33.3	37.4	34.0	30.2	33.9	+0.6
1891–92	39.3	23.9	36.4	33.2	39.6	25.6	36.8	34.0	+0.8
1892–93	26.0	21.8	26.6	24.8	27.2	22.0	26.9	25.4	+0.6
Mean				31.5				32.4	+0.9
	Washington, D. C.				Georgetown, D. C.				
1870–71	34.0	32.6	35.9	34.2	34.3	31.7	36.7	34.2	0.0
1871–72	32.1	31.7	33.7	32.5	30.1	30.4	32.1	30.9	—1.6
1872–73	30.3	30.9	34.8	32.0	27.8	29.2	32.1	29.7	—2.3
1873–74	40.5	40.3	37.2	39.3	38.0	37.3	35.6	37.0	—2.3
1874–75	39.2	29.5	28.8	32.5	36.0	27.1	27.2	30.1	—2.4
Mean				34.1				32.4	—1.7
	Cincinnati, Ohio (not W. B.).				Cincinnati, Ohio (W. B.).				
1870–71	30.8	34.5	36.6	34.0	30.9	36.8	39.3	35.7	+1.7
1871–72	29.7	28.2	32.3	30.1	32.6	30.5	33.6	32.2	+2.1
1872–73	25.4	27.1	31.3	27.9	29.1	30.8	35.5	31.8	+3.9
Mean				30.7				33.2	+2.5

†Values for series 1867–1873, inclusive, from voluntary records; for series 1882–1892 from Weather Bureau records.

In this connection it should be borne in mind that the data prior to the establishment of the Weather Bureau stations were obtained from instruments believed to have been exposed in shelters over sod, and in the open, and which, during the winter time, would give lower temperatures than instruments having exposures such as obtain at Weather Bureau stations. This fact would modify, if not reverse, the slight apparent higher average temperature during the second 25-year period at the majority of stations; and this statement is, I think, fully borne out, especially if the mixed data for Forts Snelling and Leavenworth are omitted, by comparing the data given in Table 2 for the two 25-year periods with each other, and with the winter of 1903–4, which shows that the winter of 1903–4 at Cleveland, Ohio, was by 0.4° the coldest, and at New Bedford 1.3° the coldest, in fifty years. Washington, D. C., had one winter colder and one with the same mean, both in the first twenty-five years; at Charleston one was colder in each period; Chicago and Cincinnati, each, one colder, in the first period; St. Louis, three colder in the first and five colder in the second period; New Orleans, eight winters colder in the first period (17 years) and nine colder in the second; Fort Leavenworth, fourteen colder in the first period and eleven colder in the second; and Fort Snelling, six colder in the first and five colder in the second period.

By reference to the article "The winter of 1903–4," page 125 of the MONTHLY WEATHER REVIEW for March, 1904, it will be found that the last winter was unusually cold over the portion of the United States covered by the accompanying data only.

TABLE 4.—*Thermometer exposure.*

Station and date of establishment.	Kind of shelter.	Height above ground.	Date changed.	Intervals.	
				Years.	Months.
		Feet.			
St. Paul, Minn., Nov. 1, 1870	Window	32	Apr. 16, 1883	12	6
Do	Window	44	Sept. 1, 1885	2	4
Do	Roof	114	Nov. —, 1903	8	2
Do	Roof	102	Present	0	7
Leavenworth, Kans., May 26, 1871	Window	34	Jan. 1, 1892	20	8
Do	Roof	95	Nov. 10, 1893	1	10
Kansas City, Mo., July 1, 1888	Roof	86	May 1, 1890	1	10
Do	Roof	78	Present	14	1
New Orleans, La., Oct. 24, 1870	Window	7	Nov. 18, 1871	1	1
Do	Window	29	Mar. 3, 1880	8	3
Do	Window	45	Aug. 1, 1885	5	4
Do	Roof	87	July 19, 1890	5	0
Do	Roof	112	Oct. 31, 1900	10	3
Do	Roof	88	Present	3	8
St. Louis, Mo., Oct. 12, 1870	Window	70	July 15, 1871	0	9
Do	Window	72	Mar. 3, 1873	1	9
Do	Window	84	Apr. 1, 1879	6	1
Do	Roof	105	Sept. 15, 1883	4	5
Do	Roof	70	Sept. 1, 1887	4	0
Do	Dome	107	Oct. 1, 1892	5	1
Do	Dome	110	Aug. 16, 1903	10	10
Do	Roof	208	Present	0	10
Chicago, Ill., Oct. 14, 1871	Window	42	June 14, 1872	0	8
Do	Window	74	June 8, 1873	1	0
Do	Window	70	Dec. 31, 1886	13	6
Do	Roof	144	Feb. 1, 1890	3	1
Do	Roof	241	Present	14	5
Cincinnati, Ohio, Oct. 12, 1870	Window	68	Jan. 1, 1885	14	5
Do	Roof	84	Mar. 1, 1885	0	2
Do	Roof	153	Aug. 16, 1898	13	6
Do	Roof	152	Present	5	10
Cleveland, Ohio, Oct. 17, 1870	Window	30	Apr. 30, 1873	2	6
Do	Roof	45	July 26, 1879	6	3
Do	Roof	73	Nov. 14, 1884	5	3
Do	Roof	82	July 1, 1888	3	7
Do	Roof	69	Oct. 14, 1889	1	4
Do	Roof	118	Jan. 1, 1891	1	2
Do	Roof	97	May 1, 1892	1	5
Do	Roof	122	Oct. 1, 1896	4	6
Do	Roof	100	Present	7	9
Washington, D. C., Nov. 1, 1870	Window	44	Aug. 15, 1888	17	8
Do	Roof	58	Mar. 29, 1889	0	8
Do	Roof	59	Present	15	3
Charleston, S. C., Jan. 1, 1871	Window	41	Jan. 1, 1886	15	0
Do	Roof	60	Feb. 1, 1897	11	1
Do	Sod	14	Present	7	5

THE CROW CREEK FLOOD OF MAY 20, 1904, AT CHEYENNE, WYO.

By W. S. PALMER, Section Director, Cheyenne, Wyo.

The most disastrous flood in the history of Cheyenne occurred on the night of May 20, 1904, when, as a consequence of heavy rains or cloudbursts over its upper drainage area, Crow Creek became a raging torrent, overflowing its banks, flooding the adjacent lowlands, and carrying away bridges and houses. The flood was unusual, as Crow Creek is normally but a small stream, and during much of the summer and fall its flow is so much reduced that a person can readily step across its bed.

Crow Creek rises in the mountains west of Cheyenne, and is formed by the junction of three streams, South Crow, Middle

Crow, and North Crow. The drainage area west of Cheyenne embraces a territory of approximately 350 square miles, the elevation of which varies from 6000 to 9000 feet above sea level.

The rainfall over southeastern Wyoming during the first two decades of May was unusually heavy, but the snowfall during the previous winter had been unusually light. No precipitation records had been kept in the Crow Creek Valley, except at Cheyenne. During the night of the 19th, a rainfall of 0.63 of an inch was recorded at Cheyenne, followed on the 20th by 1.10 inches, nearly one inch of which fell between 4 and 5 p. m. It is to be regretted that more extensive rainfall records for Crow Creek Valley are not available, as it is probable that the precipitation was much heavier along the valley of Middle and South Crow than at Cheyenne; at least reports and circumstances seem to so indicate.

The streets of Cheyenne were flooded during the afternoon and evening, although little or no damage was done on the higher grounds. The damage was done on the lowlands along the course of the creek, which skirts the western edge of the city, flows beneath the tracks of the main line of the Union Pacific Railroad, and then through the south side of Cheyenne.

The large volume of water poured into the creek during the afternoon raised the stream to an unprecedented height, reliable reports indicating that the wall of water which swept down the creek during the evening was from 20 to 25 feet high in places. Owing to lack of telephonic communication, no warning could be given the people of the approaching flood, and the residents on the "flats" along the creek in the western part of Cheyenne were caught in their homes, with no chance for escape except through the raging waters. The crest of the flood reached Cheyenne about 9 p. m., local time, and within two hours had begun to subside. By the following morning the creek was again confined within its banks.

The greatest danger from the flood was in west Cheyenne, on the "flats," where the water was somewhat checked in its flow by the embankment of the Union Pacific Railroad tracks, and where all of the lowlands were flooded to a depth of from 4 to 10 feet. The fire bells brought the people to the scene, and willing hands did all that could be done to rescue the people from their homes, which in some cases were being carried away by the flood. Row boats were rapidly brought from a lake about a mile away. Mounted men readily rode into the flood, at the risk of their lives, and brought people to places of safety. The darkness of the night made the work of rescue exceedingly dangerous, but the rescuers were spurred to their greatest efforts by the cries of the imprisoned people. Although many were in imminent danger of drowning, the loss of life was limited to two children.

The damage from the flood was not as great on the south side, where the creek had a chance to overflow a much wider section, with a consequent diminution in the rapidity of the flow. While some fences, walks, and outbuildings were slightly damaged, no dwellings were washed away.

The loss from the flood throughout the entire Crow Creek Valley is difficult to estimate, but it was probably more than $100,000. Several miles of the Colorado & Southern Railroad tracks were washed away above Cheyenne, and the bridge on the Denver division of the Union Pacific Railroad was so much damaged that traffic was suspended for two or three days. There was not a bridge left in serviceable condition across the creek, except the bridge on the main line of the Union Pacific Railroad. Two substantial steel bridges in the city were ruined, besides several bridges of cheaper construction. Some damage was done at Fort D. A. Russell, 4 miles west of Cheyenne. On the "flats" in west Cheyenne about a dozen houses were washed from their foundations.

A reliable estimate of the flow of the creek during the passage of the flood wave places it at 7000 cubic feet per second, or a total of over 70,000,000 cubic feet during the three hours of highest water. The normal flow of Crow Creek is but 10 cubic feet per second. The highest water ever gaged in the Laramie River, which drains an area ten times as great as the area drained by Crow Creek above Cheyenne, was but 6500 cubic feet per second, 500 cubic feet less than the estimated flow of Crow Creek during the flood of May 20, 1904.

RECENT PAPERS BEARING ON METEOROLOGY.

Mr. H. H. KIMBALL, Librarian, etc.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the Library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau. Unsigned articles are indicated by a ——.

Broad Views. London, Vol. 1.

Eliot, John. The Meteorology of the Empire, during the Unique Period 1892–1902. Pp. 191–201.

Nature. London. Vol. 70.

Lodge, Oliver. Steps toward a New Principia. Electricity and Matter. Pp. 73–76.

Borgmann, L. Radio-activity of Russian Muds and Electrification of Air by Metals. Pp. 80–81.

—— The Stability of Solar Spectrum Wave-Lengths. P. 87.

Symons's Meteorological Magazine. London. Vol. 39.

Bonacina, L. The Varying Distribution of Atmospheric Pressure over the Surface of the Earth. Pp. 62–65.

Clements, Hugh. Some Weather Prophets. Pp. 65–66.

Scottish Geographical Magazine. Edinburgh. Vol. 20.

Dingelstedt, Victor. The Riviera of Russia. [Climate.] Pp. 285–305.

Philosophical Transactions of the Royal Society of London. London. Series A. Vol. 202.

Poynting, J. H. Radiation in the Solar System: Its Effect on Temperature and its Pressure on Small Bodies. Pp. 525–552.

Knowledge. London. New Series. Vol. 1.

Baden-Powell. Aeroplane Experiments at the Crystal Palace. Pp. 111–114.

Scientific American Supplement. New York. Vol. 57.

—— Electrical Methods of Measuring Temperature. Pp. 23768–23769.

De Forest, Lee. Concerning Wireless Telegraph Transmitters P. 23779.

Science. New York. Vol. 19.

Lindsey, Edward. A Reddish-Brown Snowfall. P. 893.

F., W. S. The Electron Theory. Pp. 896–899.

—— Professor Rutherford on Radium. [Review of lecture of E. Rutherford.] Pp. 899–900.

Davis, Bergen. A suggestive relation between the Gravitational Constant and the Constants of the Ether. Pp. 928–929.

Electrical World and Engineer. New York. Vol. 43.

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Reynolds, Frederick G. The Viscosity Coefficient of Air, with an inquiry into the Effect of the Röntgen Rays thereon. Pp. 419–431.

Astrophysical Journal. Chicago. Vol. 19.

Langley, S. P. On a possible variation of the Solar Radiation and its probable effect on Terrestrial Temperatures. Pp. 305–321.

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Ward, R. DeC. Rainfall and Crops in California. [Review of article of A. G. McAdie.] Pp. 277–278.

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Vanderlinden, E. Les végétaux et la gelée. Pp. 121–128.

Lockyer, N. Simultanéité des changements solaires et terrestres. Pp. 128–137.

—— Le climat de la Mandchourie. [Review of communications of J. Ross.] P. 168.

Annuaire de la Société Météorologique de France. Paris. 52me année.

Gorodensky, M. Recherches concernant l'influence de la rotation diurne de la terre sur les perturbations atmosphériques. Pp. 113–120.

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Violle, J. Rapport sur la radiation au Comité international météorologique à Southport, en 1903. Pp. 134–144.

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Auerbach, Bertrand. Le régime de la Weser. Pp. 257–265.

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B. L'eau de neige. Pp. 104–107.

Bracke, A. Le mammatus. Pp. 111–115.

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Hammer, —. Ueber die Barometerformel von Laplace. [Review of article of L. Maillard.] Pp. 123–124.

—— Ueber die elastiche Nachwirkung bei Aneroid-Barographen. [Review of article of R. Rosenthal.] P. 124.

M., J. Ueber die Intensität des Sonnenlichts. [Review of article of Ch. Fabry.] Pp. 124–125.

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Boltzmann, A. Eine Fahrt auf 5380 Meter. [Scientific Balloon Ascension.] Pp. 95–97.

Himmel und Erde. Berlin. 16 Jahrgang.

Süring, R. Ueber Wolkenformen und deren Veränderungen. Pp. 337–350.

Illustrierte Aëronautische Mitteilungen. Strassburg. 8 Jahrgang.

Berson, Arthur, and Elias, Hermann. Drachenaufstiege auf der Ostsee, den Norwegischen Gewässern und dem Nördlichen Eismeers. Pp. 153–157.

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Elias, H Der Zustand der Atmosphäre an Nebeltagen. Pp. 97–106.

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Rudolph, H. Luftelektrizität, Eigenladung der Erde und Aktivität der freien Luft. Pp. 213–218.

Hegyfoky, J. Zur jährlichen und täglichen Periode der Wolkengeschwindigkeit. Pp. 220–224.

Exner, Felix M. Messungen der Intensität der Sonnenstrahlung auf Spitzbergen. Pp. 224–225.

—— F. A. Förel über die Kontinuität des Bishopschen Ringes. Pp. 225–226.

Reimann, —. Ring um die Sonne. P. 226.

—— Lad. Gorczynski über die Abnahme der Intensität der Sonnenstrahlung im Jahre 1902 und 1903. P. 226.

Exner, Felix M. Atmosphärische Radio-Aktivität in hohen Breiten. Pp. 226–227.

—— J. Elster und H. Geitel über die radioaktive Substanz, deren Emanation in der Bodenluft und der Atmosphäre enthalten ist. P. 227.

—— Luftelektrische Messungen im Hochtal von Arosa. Pp. 227–228.

—— J. Hann über die Luftströmungen auf dem Gipfel des Säntis (2504m) und ihre jähliche Periode. Pp. 228–230.

Ehrenfeucht, —. Ueber die doppelte tägliche Oszillation der Windrichtung in Warschau. Pp. 230–231.

Ed. Mazelle. Ueber den Einfluss der Bora auf die tägliche Periode einiger meteorologischer Elemente. P. 231–232.

Friesenhof, —. Die Temperatur-Depressionen im Monate Mai, zugleich ein Beitrag zur Frage der Eismännerperiode und des Urban. Pp. 232–235.

—— Barometerbeobachtungen in Langenburg am Nyassa. Pp. 235–236.

—— Ueber Abnahme der Horizontal-Intensität des Erdmagnetismus. P. 237.

Weber, L. Zur Gewitter-Fernregistrierung. P. 237–238.

Nitzl, —. Einfluss der Aufstellung des Regenmessers. P. 238.

—— Klima von Köln a Rh. Pp. 238–239.

Hann, J. Die Jahressummen des Regenfalles zu Padua 1725–1900. P. 239.

Danckelman, von. Regenbeobachtungen aus Siam. Pp. 240–241.

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Mk. Der Januar 1904 in Tokio. 244–245.

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—— Der internationale Wolken-Atlas. Pp. 245–246.

—— Zusammensetzung der atmosphärischen Luft. P. 246.

Hemel en Dampkring. Amsterdam. 2 Jaargang.

Bracke, A. Onze wolkenwaarnemingen. Pp. 12–14.

NOTES AND EXTRACTS.

TORNADO IN INDIAN TERRITORY.

Mr. C. M. Strong, Section Director, Oklahoma, Okla., sends data relative to a tornado on April 24. The tornado was first heard of at Choteau, Ind. T. It began in the Verdigris River bottoms, and extended northeast to the northern part of the Cherokee Nation country. Destruction is reported from Choteau, Fairland, and Clearwater. Large hailstones and a deluge of rain accompanied the tornado in the Cherokee Nation. A general electric storm prevailed all day, followed by a heavy downfall of rain and then by the tornado.

The postmaster at Ketchum reports that the storm passed through that place about 12 o'clock (probably central time), leaving the river bottom and striking the hills and then the prairie beyond. The storm was visible for five or ten minutes as it passed in a northeast direction, a little east of Ketchum.

It moved up the Grand River Valley, reaching Cleora, Ind. T., 7 miles south of Afton, on Sunday, April 24, at 12:25 p. m.

The postmaster at Afton thinks possibly there were two storms traveling parallel with each other 6 or 7 miles apart, each of them destroying everything it came in contact with when it descended to the ground, and each path of destruction ranging from 150 to 300 feet wide. As a rule houses that were destroyed were carried and scattered to the northeast. The storm was pretty generally over in twenty minutes, covering a territory measuring 6 or 7 miles east and west and 30 miles north and south.

The postmaster at Fairland says: "Storm came at 12:35 p. m., after a heavy rain of about thirty minutes with some hail. It was noticed some half hour before, but thought it was going west of us. It came from the south and lasted about one minute. The path of the destructive wind was about 400 yards wide; débris was thrown in all directions. Some observed the funnel-shaped cloud, but I did not. The cloud lifted after leaving here and no damage was reported north of us."

It was last observed at Fairland. The funnel cloud was noted, but the first intimation of the approach of the tornado was a loud, roaring noise. The general direction of the path was north and east, and the width of the path of destruction about one-fourth of a mile.

From Choteau to Fairland the track covers about 60 miles in length. The storm is said to have been the worst that has been known in the Indian Territory.

TORNADO AT GRAND RAPIDS, MICH.

The following details of a tornado at Grand Rapids, Mich., on March 24, are obtained from the report of Mr. C. F. Schneider, Section Director at that place. The tornado moved in a due northeasterly direction across the southeastern portion of the city, over a path about 2 miles long and from 25 to 200 feet in width. Nothing could be learned regarding the appearance of the sky or the atmosphere during the passage of the tornado, because it had been a wet, stormy evening, and almost everyone was indoors.

At the Weather Bureau office, distant about 2½ miles from the nearest point of the storm's path, the records show a steadily increasing southeasterly wind from about 8 p. m. (seventy-fifth meridian time), until 10 p. m., when it had reached a velocity of 32 miles. At 10:05 p. m., when the wind had suddenly shifted to the southwest, it attained a maximum velocity of 52 miles. It then decreased with equal sudden-

ness, falling to 16 miles per hour by 10:30 p. m. Rain, accompanying a heavy thunderstorm, began at 9:10 p. m., and during the very high wind came down in a deluge, 0.06 of an inch falling in about two minutes. Although no hail fell at the Weather Bureau office, large, opaque hailstones, about half an inch in diameter, fell in the storm track immediately after the wind rush ceased.

Damage by the tornado amounted to about $15,000 and several persons were injured.

The tornado occurred at 10:05 p. m., which was the time of maximum wind velocity at the Weather Bureau station.

LOCAL COOPERATION IN FROST PREVENTION.

Mr. Richard H. Sullivan, Observer, in charge of the Weather Bureau station at Grand Junction, Colo., reports the result of his efforts to raise a healthy sentiment in that locality in favor of employing concerted artificial methods for the prevention of damage by frost. Having on all occasions advocated the use of smudges on a generous scale, he was finally able to bring about a practical illustration of the value of his idea of combined effort.

On April 21, a frost warning was issued by the district center through the local office, and this was in turn given the widest possible distribution. Consultation with the officers of the Fruit Growers' Association and other citizens resulted in a meeting at the office of the Daily Sentinel, where ways and means were discussed, the mayor of the city extending the influence of his office toward enlisting the efforts of the residents to assist in smudging the whole valley if necessary. Therefore, on account of the warning and also the comparatively low temperature prevailing, the mayor issued a proclamation calling on all citizens to prepare smudge piles. The local office was designated as the central point for information as to the fall in temperature during the ensuing night, and Messrs. Adams and Moore agreed to assist in the work of urging all fruit growers to make preparations. Arrangements were made with Mr. G. W. Peugh, Manager of the Colorado Telephone Company's exchange in this city, for extra night service. Mr. Peugh detailed two operators for the work, with instructions to call the observer should dangerous temperatures be reported before the agreed hour of 3 a. m., local time, the following morning. Under the mayor's instructions, the city employees under the street commissioner placed wagonloads of manure and rubbish in all the open lots of the city, and the residents very generally responded to the request of the mayor by placing smudge piles in their back yards. By midnight the work of placing 1000 large smudge piles in the city limits was completed. It was agreed that the time for lighting was to be determined after consultation with the orchardists by telephone at or before the appointed hour, all connections to be made with the line running to the Weather Bureau office, so that each individual could hear observed temperatures and discuss ways and means with his neighbors up and down the line. A continued fall in the temperature resulted in the decision to start the general smudge at 5 a. m., local time, April 22. By 5:30 a. m. the whole valley was covered with a sheet of dense smoke 50 to 75 feet deep, 8 to 10 miles wide, and about 40 miles long. The winds being light, the smoke seemed to settle well over everything, drifting slowly over the valley with changing currents, similar to a dense fog, and the first systematic smudge ever attempted in the valley was successfully in operation. A light frost was discovered, by careful examination, under tufts of alfalfa along the city ditches, but none on the walks or in the open. No damage resulted, due, many orchardists affirm, to the thorough manner in which smudging was carried out. By 10 a. m., local time, the smoke had almost entirely disappeared. On the night of the 23d–24th, preparations were made for a second combined effort, but the night passed without its being necessary to light the fires. At 3 a. m. of the 25th, local time, the Weather Bureau office was again opened, and temperature reports were received and compared. Toward daylight, the temperatures had fallen to 37° in the vicinity of Grand Junction and to 33° farther northwest. Smudge fires were started over a large area, and but slight damage was reported. At 4 a. m. of the 30th, the office was again opened for business, but comparison of temperatures showed that smudging was not necessary. The Chamber of Commerce united in an expression of appreciation of Mr. Sullivan's attention to the interests of the community and of gratification at the good results of the work.

THE TRIENNIAL MEETING, APRIL, 1904, OF THE GERMAN METEOROLOGICAL SOCIETY.

There was a considerable attendance at the triennial meeting of the German Meteorological Society, held at the Institut für Meereskunde in Berlin during Easter week, under the presidency of Professor von Bezold. Numerous papers were read and discussed, those on April 7 and 9 being mainly meteorological, and those on April 8 electrical and magnetical, the one which occasioned the most animated discussion being communicated by Professor Holdefleiss, Halle, "Ueber die meteorologischen Ursachen des Auswinterns des Getreides." On the afternoon of April 7 the members were conducted over the Meteorological Institute in the Schinkelplatz; that of April 8 was devoted to the Physical Observatory at Potsdam; that of April 9 to the meteorological and military balloon and kite flying establishments at Tegel, and the evening to the Geographical Society's meeting; and Sunday evening to the Astronomical Observatory at Treptow. At Tegel, the Luftschiff military section charged a balloon of 600 cubic meters within three minutes; within fifteen minutes it had been attached to its car, and with two officers aboard had disappeared beyond the clouds. The military authorities also carried out wireless telegraph experiments by means of kites. Dr. Assmann, in charge of the meteorological station, had observations taken at a considerable elevation by means of a kite, and also dispatched a small rubber free balloon with a set of instruments attached.—*From Nature, April 21, 1904, p. 587, vol. 69.*

THE METEOROLOGY OF THE UPPER AIR.

The international commission for scientific balloon ascensions has, as is well known, published during the past year in great detail the results of work with balloons and kites and on high mountain stations during the years 1901, 1902, and 1903. It proposes to continue this publication, but, according to a recent circular, there will be added thereto an appendix or series of papers, published at irregular intervals, containing special investigations on the results of the international balloon ascensions. It seems that the great mass of data now rapidly accumulating is likely to frighten individual students from undertaking the necessarily tedious investigations suggested thereby, and that many valuable results will remain hidden from the world unless the International Committee promptly supervises the discussion and publication of such results as can be attained. This will also be a valuable means of improving future work. The development of meteorology depends more upon the prompt discussion and publication of data obtained from the upper atmosphere than upon any other class of work that is now being carried on by observers as such. On the other hand, a still more important class of work is that which relates to the improvement of the mathematical methods of treating the mechanical and physical theories of the motions of the atmosphere, and this subject will undoubtedly be fully provided for by the international commission. Subscriptions for the proposed appendix to the international observations at great altitudes will be received by the firm of H. Trübner, Strassburg.

THE METEOROLOGY OF JAMAICA.

The Institute of Jamaica has just published a handy pamphlet by Maxwell Hall, esq., on the meteorology of that island. To this subject Mr. Hall has given especial attention during his long and active life, and is properly recognized as our highest authority. Besides describing the instruments, the stations, and the laws of storms for the West Indian cyclones, he also gives a list of the more important articles that have been published in the monthly weather reports compiled by him for the Weather Service of Jamaica since 1880. We quote the following from among the numerous interesting items relative to clouds:

1. *Cirrus.*—Cirrus clouds are often seen in the morning about sunrise during the summer and autumn months, but they rapidly disappear as the temperature of the day increases. Under these circumstances they are fine-weather clouds, and it is only when they increase in extent and develop into cirro-stratus that they can be connected with bad weather. There is a well-marked upper current from the east-northeast during the

autumnal months, as shown by the following table of percentages, based on observations at Kempshot Observatory.

Average drift from—	Relative number of cases.	
	Cirrus.	Cirro-stratus.
North	7	9
Northeast	26	25
East	28	27
Southeast	8	18
South	4	6
Southwest	7	6
West	13	5
Northwest	7	4
	100	100

This table shows that the highest wind from the west and northwest occurred less frequently than that from the northeast and east, or, in other words, that in about 27 per cent of cases the east and northeast currents reached from the lower clouds up to the highest cirrus and doubtless beyond, but probably the westerly wind prevailed above that, even during the autumnal months. Maxwell Hall adds:

The existence of this still higher current from the west has been confirmed at times by the drift of long continuing trails of shooting stars and by the drift of dust from volcanoes in eruption.

With regard to the strato-cirrus, Mr. Hall says:

When rain begins to fall from a large cumulus, a quantity of cloud is poured into the air from the top of the cumulus, as smoke from a factory chimney. This takes place in all parts of the world when rain falls from cumuli, but in the temperate zones only a little cirriform cloud is thrown off. In Jamaica the process is on a gigantic scale, and the cloud is spread out as a sheet far and wide, so as to shade the land for some hours from the direct rays of the afternoon sun. It is therefore a common cloud in the west-central district of Jamaica during the summer and autumn months. Its texture at first is thick and woolly, but as it spreads the sheet becomes thinner. It then settles down, often passing through different forms, and finally disappears, leaving the evening sky perfectly clear.

Now, by means of a sextant, some careful observations were made of the altitude of the tops of well-formed cumuli whose distances could be ascertained by their rain falling on mountain ranges or by the average interval between the thunder and lightning; and it was found that the average height of such well-formed cumuli was as much as 6 miles. At this elevation the temperature is below zero, and strato-cirrus, when spread out as described above, must be very fine snow, as distinguished from the very minute particles of ice which form cirrus and cirro-stratus. This fine snow then falls slowly by its own weight, and, melting, it often produces those quiet after-rains that follow the heavy rains and squalls of the cumulus.

From what has been said about the spreading out of this cloud, it might be supposed that it had no average drift; but if well-formed cumuli at considerable distances be watched it will be found that, while their average drift is from the southeast over the western half of Jamaica, the drift of the strato-cirrus issuing from them is generally northeast. (From northeast?—ED.).

With regard to the origin of hurricanes, Mr. Hall says:

If we look at the pilot charts published each month by the U. S. Hydrographic Office, we shall see that when the region of equatorial heavy rains between South America and Africa reaches as far north as latitude 15° cyclones originate in about that latitude, but to the west of the region of heavy rains, and then move off on a westerly course. As the diverting effect of the earth's rotation upon currents of air is very important for the development and maintenance of cyclones, and as this effect varies as the sine of the latitude, there are no cyclones near the equator or within 12° of it; but, as we have seen, at 15° the effect is sufficient to give the currents the necessary divergence. Now, as the region of heavy rains advance as far north as latitude 15° in August, somewhat farther in September and October, but withdraws far to the south in November, and remains there until the following July, it is evident that August, September, and October are the months in which cyclones usually occur in the West Indies. Of course they may occur at other places and at other times if all the essentials are present and combine.

THE CURIOUS WORK OF THE WIND.

In the earlier years of the Weather Bureau it was not uncommon for an observer to send to the Central Office, for exhibition in its museum, some tree trunk studded with straws driven into it by a tornado wind, or twisted into shreds by the action of the wind, or split open by lightning. Lately we have received from Professor McAdie a most instructive illustration of wind work, namely, a Weather Bureau storm-warning flag that had been exposed at the Weather Bureau office, Southeast Farallon Island, Cal., during a recent high wind. Not only is this flag torn into shreds, but the shreds were so interlaced and knotted together as to preserve in permanent form many of the intricate movements of the wind as it whirled past the flagstaff. These movements are easily seen when one watches the fall of snowflakes. The actual path pursued by a particle of atmosphere is undoubtedly not only very complex, but much longer than the path registered by any form of anemometer. Therefore, the so-called internal energy of the wind is decidedly greater than would correspond to the measured velocity of the wind, just as the internal energy of a vortex ring is much greater than that of its linear movement as a whole, or just as the internal energy of a warm gas, as computed from its temperature, is much greater than the energy of the whole mass as computed from the linear movement of the mass as a whole.

INSTRUCTION IN METEOROLOGY.

Through the generosity of an unknown citizen, the city of Chattanooga has been enabled to provide its high school with a meteorological observatory, equipped with the following standard instruments: An anemometer with single register, a barometer and barometer box, hygrometer, maximum and minimum thermometers, rain and snow gage with support, and standard thermometer shelter. The instruments were presented to the school on condition that meteorology should be added to its curriculum as an optional study, and 20 copies of a text book on meteorology were given by the same person for the free use of students. The instruments were selected by Mr. L. M. Pindell, Observer at Chattanooga, and installed under his direction. Twenty-three students formed the first year's class. Mr. Pindell has assisted the teacher by occasional talks to the class and explanations of the care and use of the instruments. So far as the Editor knows, this is the first *high school* in the country to possess a meteorological laboratory, a laboratory scarcely inferior in educational value to the high school laboratories of chemistry and physics now universally recognized as indispensable in connection with thorough elementary instruction in those subjects.

HUMMING OF TELEGRAPH WIRES AND POLES.

The question is frequently asked: "What causes the humming of the telegraph wires and poles; what connection has it with the weather; can it be used for weather forecasting?" The telegraph pole merely transmits to the ear the humming of the wires over head. Its own vibrations are so slow that they make no audible sound. The wires strung from pole to pole are set into oscillation by the wind, somewhat as the strings of a violin are set into vibration by the bow. In skilful hands the violin bow can be made to bring forth from the string one powerful fundamental note and several overtones of higher pitch but in perfect harmony with the fundamental. But the wind is a very unskilful performer, and brings forth at the same time not only the deepest fundamental bass note of the wire, but a great variety of overtones, both harmonious and discordant. In fact, the many wires strung over head, from pole to pole, constitute splendid æolian harps. The slowest oscillations of the wires may be seen or felt, but are not audible. The bass notes and the higher tenor we hear but faintly when we stand midway between two poles. If the ear is pressed against a pole we hear more especially those notes to which the wooden

pole can most easily respond; sometimes a special note, started by the wire at the upper end of the pole, is reinforced by resonance, and that which is only feeble on the wire becomes most prominent on the pole. Of course, the stronger the wind and the more gusty it is, so much the more active will be the humming of the wire and the pole. If the wind blows lengthwise of the wire it will bring out a different combination of notes from those produced by a transverse wind. Therefore, the direction of the wind has some influence upon the humming of the telegraph poles, but the direction of the wind depends upon the location of the storm center, and is a good basis for local prediction as to rain. Hence, those who have studied the humming very closely have frequently declared that they can tell the weather by the character of the humming.

According to a clipping from the Saturday Budget, Quebec, Ont., March 12, 1904, a prominent meteorologist in Toronto has made a series of observations and arrives at the following conclusions:

* * * the humming of wires running east and west invariably presaged a fall of temperature, often ten or more hours in advance of the thermometer; the humming of wires running north and south advised a rise in temperature, almost always several hours in advance of the thermometer. Wires running east and west never hummed together with wires running north and south, not even when the same wires running along an east and west street turned down a north and south side; only that portion of them hummed that indicated a rise or fall in temperature, as explained above. If one part hummed the other part was silent.

It seems evident to us that the humming is due entirely to the action of the wind. We see no necessity for assuming that electric currents, either in the air or in the wire, or any other mystery need to be considered. Those who invoke electricity must give some plausible reason why the current should oscillate with such frequency as to cause the rapid vibrations that must exist in order to cause audible sound.

NOTE ON THE GREAT METEOR OF SEPTEMBER 15, 1902.

Since printing the article by Mr. Mosely on page 172 of the April REVIEW, he has received the following record from Thomas Mikesell, voluntary observer at Wauseon, Ohio, 33 miles west of Toledo (in latitude 41° 35′ north, longitude 84° 7′ west), who says:

Several persons about Wauseon saw the meteor, though I did not see it myself. My record states that at 5:45 a. m., central standard time, I looked out of the window and saw a curious streak, like a thin, white cloud, extending from near the east, northward about 40°. It was about three-fourths of a degree wide, of serpentine form, with a few short kinks. It continued visible for fifteen or twenty minutes and hardly moved from where I first saw it, though it changed to an ashy color. I noted the time at once on seeing it. I estimated the altitude at about 25°, perhaps a little lower at the north end.

Mr. Mosely adds:

This would seem to show that the trail remained visible at Wauseon for nearly an hour and a half after the passage of the meteor. The estimate of altitude is in substantial accord with the conclusions I had already reached.

WEATHER BUREAU MEN AS INSTRUCTORS.

Mr. Edward L. Wells, Observer, Boise, Idaho, reports that on June 10 some 30 teachers of the Ada County Teachers' Institute visited the local office of the Weather Bureau, and listened to an informal talk on the use of the instruments and the work of the Bureau. The teachers evinced more than a passing interest in these matters, and some of them desired to study the instruments more in detail in order that they might be better able to instruct their pupils.

On May 14 he addressed the class in physical geography from the Boise High School on observations and map making and the collection of meteorological data.

On June 9, Mr. Wm. G. Burns, Section Director, Springfield, Ill., addressed an advanced class from the Convers Public School on the general scope of Weather Bureau work.

Mr. J. R. Weeks, Observer, Macon, Ga., on June 3 delivered an illustrated lecture before 200 students of the Georgia-Alabama Business College on the Subject, "Weather and Business."

Mr. James H. Scarr, Observer, Sacramento, Cal., and Mr. E. Bonnett, Assistant Observer, on May 13 lectured to the class in physics from the city high school, which came to the office in two sections. The instruction consisted of an explanation of the instruments and weather maps, with some remarks on the scope and limitations of weather forecasting. Members of the class have since frequently visited the office for fuller instruction on special points.

THE WEATHER OF THE MONTH.

By Mr. W. B. STOCKMAN, District Forecaster, in charge of Division of Meteorological Records.

PRESSURE.

The distribution of mean atmospheric pressure is graphically shown on Chart VIII and the average values and departures from normal are shown in Tables I and VI.

The mean pressure for May, 1904, was highest, with readings of about 30.10 inches, on the north Pacific coast, with a secondary area of somewhat lower pressure over the middle Atlantic and New England coasts. It was lowest over the southern Platean region, with minimum readings of 29.75 inches in southern Arizona.

The mean pressure was above the normal in New England, the eastern portion of the Middle Atlantic States, eastern Texas, Missouri Valley, middle and northern slope, northern Plateau, and north Pacific regions, and slightly below normal in the remaining districts. The greatest plus departures were .10 inch in the northwestern portion of the north Pacific region, and the maximum minus departures occurred on the southern coast of and in the interior of California and ranged from —.05 to —.09 inch.

The mean pressure for the month increased over that of April, 1904, in the north Pacific region, New England, and the eastern portion of the Middle Atlantic States, and diminished in the remaining districts.

The increase in New England and the eastern portion of the Middle Atlantic States was slight, while in the north Pacific region it ranged from +.05 to +.11 inch. Over the greater portion of the area where there was a decrease the changes were quite marked, ranging from —.15 to —.20 inch, in the north-central section of the United States.

TEMPERATURE OF THE AIR.

The distribution of maximum, minimum, and average surface temperatures is graphically shown by the lines on Chart V.

The mean temperature of the month was below normal in the Southern States, except the eastern portions of Virginia, North Carolina and Kentucky, and central Florida, in Kansas, eastern and northern Colorado, Utah, Wyoming, eastern Montana, western North Dakota, northeastern Oregon, Washington, and on the south-central coast of California; and above normal in the remaining districts.

In northern and central California, south-central Arizona, the eastern parts of the Dakotas, northern lower Michigan, southeastern Wisconsin, New England, New York, eastern Pennsylvania, and northern and central New Jersey the changes were from +2.0° to somewhat more than +4.0°. The minus departures were not so large.

Maximum temperatures of 90°, or higher, occurred generally south of the fortieth degree of latitude, except in the mountain regions of the Virginias and Carolinas, middle western States, slope and Plateau regions. They also occurred in southeastern Pennsylvania, central Ohio, interior California, and north-central Oregon. Maximum temperatures of 100°, or higher, occurred in the lower Rio Grande Valley, west-central Texas, western Arizona, and interior California.

Freezing temperatures occurred in scattered localities in the Northern States, and quite generally over the slope and Plateau regions.

The average temperatures for the several geographic districts and the departures from the normal values are shown in the following table:

Average temperatures and departures from normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	8	56.8	+ 2.9	—11.6	— 2.3
Middle Atlantic	12	63.4	+ 1.9	—13.8	— 2.8
South Atlantic	10	69.7	— 0.2	— 9.8	— 2.0
Florida Peninsula*	8	76.1	+ 0.2	+ 2.7	+ 0.5
East Gulf	9	71.1	— 1.3	— 4.7	— 0.9
West Gulf	7	71.7	— 0.9	+ 4.7	+ 0.9
Ohio Valley and Tennessee	11	64.9	— 0.2	—12.8	— 2.6
Lower Lake	8	58.6	+ 1.8	—16.6	— 3.3
Upper Lake	10	53.2	+ 1.6	—16.9	— 3.4
North Dakota*	8	54.5	+ 1.6	—13.9	— 2.8
Upper Mississippi Valley	11	61.5	+ 0.1	—14.7	— 2.9
Missouri Valley	11	60.8	+ 0.7	— 3.5	— 0.7
Northern Slope	7	53.6	+ 0.1	+ 5.5	+ 1.1
Middle Slope	6	61.4	— 0.6	+ 8.2	+ 1.6
Southern Slope*	6	68.5	— 1.4	+10.9	+ 2.2
Southern Plateau*	13	64.5	0.0	+ 8.5	+ 1.7
Middle Plateau*	8	55.4	— 0.5	+ 5.1	+ 1.0
Northern Plateau*	12	55.3	+ 0.6	+11.7	+ 2.3
North Pacific	7	53.2	— 0.6	+ 0.7	+ 0.1
Middle Pacific	5	60.7	+ 2.2	+ 2.1	+ 0.4
South Pacific	4	63.0	+ 0.6	+ 3.4	+ 0.7

*Regular Weather Bureau and selected voluntary stations.

In Canada.—Prof. R. F. Stupart says:

The temperature was below the average over British Columbia and the western portion of the Northwest Territories, and above the average elsewhere throughout the Dominion. The most marked positive departures were recorded in the Ottawa and upper St. Lawrence valleys, Montreal, and Ottawa, each being 5°; Quebec was 4°, the peninsula of Ontario about 3°, and Manitoba and the Maritime Provinces 2°. The chief negative departures were Barkerville, 5°, Kamloops, 4°, Battleford, 3°.

PRECIPITATION.

The distribution of total monthly precipitation is shown on Chart III.

The precipitation was above the normal in southwestern Florida, southwestern Tennessee, scattered portions of Ohio, Michigan, except the southeastern part, northeastern Wisconsin, north-central Montana, northwestern Missouri, Kansas, Colorado, northern Arizona, Utah, Wyoming, south-central South Dakota, Nebraska, except the northeastern portion, and east-central Texas; elsewhere the precipitation was below the average.

The excess in precipitation was marked in southern Florida, east-central Texas, Wyoming, northwestern Missouri, northeastern Kansas, northeastern Wisconsin, and upper Michigan. The deficiency in precipitation was not so marked, but equaled or exceeded 2.0 inches in southern North Carolina, South Carolina, northeastern Georgia, north-central Kentucky, southwestern Missouri, central Arkansas, southern Mississippi, southwestern Alabama, extreme western Florida, and southwestern Washington.

The greatest amounts of precipitation were reported from southern Florida, east-central and southern Texas, northwestern Missouri, northeastern Kansas, and southeastern Wyoming.

No measurable amounts of snowfall occurred except over the Upper Michigan Peninsula and at elevated points in the mountain and Plateau districts.

HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 7, 29, 30. Arizona, 1, 11, 21, 24. Arkansas, 5, 8, 17, 26, 29. California, 1, 18, 25, 27, 28. Colorado, 1, 2, 3, 4, 7, 15, 16, 18, 19, 20, 21, 24, 25, 26, 28, 30, 31. Connecticut, 19. District of Columbia, 19. Florida, 2, 20, 30, 31. Georgia, 9, 23, 29, 30, Idaho, 6, 14, 19, 24. Illinois, 7, 9, 12, 14, 18, 22, 23, 24, 26. Indiana, 3, 9, 10, 14, 15, 23, 24. Indian Territory, 1, 5, 16, 17, 29. Iowa, 5, 7, 9, 12, 13, 17, 22, 24, 25. Kansas, 3, 4, 5, 6, 7, 8, 23, 24, 25, 26, 28, 29, 31. Kentucky, 23, 24, 25, 26, 29. Louisiana, 1, 5, 13, 28, 29, 30. Maine, 19, 20, 28. Maryland, 1, 30. Massachusetts, 15, 16, 20, 25, 26. Michigan, 10, 13, 14, 15, 22, 26, 29. Minnesota, 5, 7, 8, 10, 12, 13, 22, 23, 24, 25. Mississippi, 5, 8, 16, 29, 30. Missouri, 5, 9, 17, 18, 22, 23. Montana, 6, 7, 10, 14, 31. Nebraska, 5, 7, 8, 12, 16, 20, 23, 24, 25, 26, 29, 30, 31. Nevada, 20, 24, 25, 26, 27. New Hampshire, 16, 25, 26. New Jersey, 19, 27. New Mexico, 2, 4, 6, 18, 20, 21, 22, 23, 24, 25, 26, 27, 28. New York, 15, 18, 19, 22, 23, 25, 26. North Carolina, 2, 3, 9, 10, 17, 18, 26, North Dakota, 1, 5, 6, 8, 10, 11. Ohio, 3, 10, 15, 18, 23, 24, 25, 26. Oklahoma, 3, 6, 7, 8, 12, 15, 16, 25, 28, 29. Oregon, 6, 17. Pennsylvania, 1, 14, 15, 19, 25, 26, 27. Rhode Island, 16, 18. South Carolina, 3, 31. South Dakota, 4, 8, 12, 24, 28, 30, 31. Tennessee, 4, 5, 7, 13, 26, 27, 29. Texas, 1, 2, 4, 5, 6, 7, 12, 13, 16, 17, 27, 28, 29. Utah, 7, 14, 17, 19, 20, 21, 23, 24, 25, 26, 27. Virginia, 2, 9, 18, 24, 25, 26, 27, 31. Washington, 4, 6, 18. West Virginia, 10, 14, 15, 18, 29. Wisconsin, 8, 12, 22, 23, 29. Wyoming, 1, 2, 3, 4, 6, 7, 10, 14, 15, 19, 20, 21, 24, 27, 30, 31.

SLEET.

The following are the dates on which sleet fell in the respective States:

Arizona, 1. Colorado, 1, 2, 3, 4, 5, 7, 14, 15, 21. Michigan, 8, 9, 10, 13, 14, 15, 16. Minnesota, 9, 13, Nebraska, 12. Nevada, 1, 2, 25, 26. New Mexico, 2, 3. New York, 15. North Dakota, 11, 12, 13. Ohio, 15. South Dakota, 12. Utah, 1, 2, 24, 26. Washington, 4. Wisconsin, 14.

Average precipitation and departure from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	8	3.18	89	—0.4	—0.3
Middle Atlantic	12	2.23	61	—1.4	—5.7
South Atlantic	10	2.09	52	—1.9	—7.1
Florida Peninsula*	8	3.68	103	+0.1	+0.8
East Gulf	9	2.66	64	—1.5	—10.6
West Gulf	7	4.16	95	—0.2	—4.6
Ohio Valley and Tennessee	11	3.20	84	—0.6	—3.5
Lower Lake	8	3.10	91	—0.3	+2.8
Upper Lake	10	3.85	115	+0.5	+0.2
North Dakota*	8	1.54	72	—0.6	—0.3
Upper Mississippi Valley	11	3.49	83	—0.7	—0.5
Missouri Valley	11	4.34	105	+0.2	+0.1
Northern Slope	7	3.38	148	+1.1	+0.2
Middle Slope	6	4.19	117	+0.6	—0.8
Southern Slope*	6	3.74	93	—0.3	—3.2
Southern Plateau*	13	0.60	100	0.0	—2.1
Middle Plateau*	8	1.64	174	+0.7	+2.0
Northern Plateau*	12	0.67	36	—1.2	+0.5
North Pacific	7	1.14	40	—1.7	+1.5
Middle Pacific	5	0.36	23	—1.2	+4.9
South Pacific	4	0.11	35	—0.2	—0.4

*Regular Weather Bureau and selected voluntary stations.

In Canada.—Professor Stupart says:

The rainfall was very deficient over British Columbia, as well as over Manitoba and the Northwest Territories, except locally in the Qu'Appelle Valley and northeastern Saskatchewan. It was also below the average in portions of Ontario east and north of the eastern part of Lake Ontario. Eastern Nova Scotia and Prince Edward Island were likewise below average, whereas Quebec and the large remaining portions of Ontario

and the Maritime Provinces were nearly everywhere well above the average. The most noticeable positive departures were Father Point, 4 inches; Montreal, 2 inches; Parry Sound, 2.4 inches, and the chief negative departures were Barkerville, 1.5 inches; Kamloops and Edmonton, 1.2 inches; Minnedosa, 0.8 inch; Sydney, 1.5 inches; Charlottetown, 1.0 inch.

CLEAR SKY AND CLOUDINESS.

The distribution of clear sky is graphically shown on Chart IV, and the numerical values of average daylight cloudiness, both for individual stations and by geographic districts, appear in Table I.

The cloudiness was normal in the Ohio Valley and Tennessee and North Dakota; above normal in the Lake region, Missouri Valley, and the middle slope and middle and southern Plateau regions; elsewhere it was below the normal.

The average cloudiness for the various districts, with departures from the normal, are shown in the following table:

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	4.9	— 0.6	Missouri Valley	5.6	+ 0.2
Middle Atlantic	4.6	— 0.6	Northern Slope	4.5	— 0.9
South Atlantic	3.8	— 0.6	Middle Slope	5.6	+ 0.8
Florida Peninsula	4.4	— 0.1	Southern Slope	3.8	— 0.7
East Gulf	3.6	— 0.7	Southern Plateau	2.7	+ 0.5
West Gulf	4.4	— 0.5	Middle Plateau	4.2	+ 0.1
Ohio Valley and Tennessee	5.1	0.0	Northern Plateau	5.2	— 0.4
Lower Lake	5.5	+ 0.3	North Pacific	5.4	— 0.5
Upper Lake	5.9	+ 0.4	Middle Pacific	2.8	— 1.4
North Dakota	5.3	0.0	South Pacific	3.8	— 0.4
Upper Mississippi Valley	5.0	— 0.2			

HUMIDITY.

The relative humidity was normal in the southern Plateau region; above normal in North Dakota, upper Mississippi Valley, the northern and middle slope and Plateau and south Pacific regions; and below normal in the remaining districts.

The averages by districts appear in the subjoined table:

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	76	— 2	Missouri Valley	64	— 1
Middle Atlantic	68	— 4	Northern Slope	64	+ 6
South Atlantic	68	— 6	Middle Slope	66	+ 5
Florida Peninsula	75	— 1	Southern Slope	59	— 2
East Gulf	65	— 6	Southern Plateau	32	0
West Gulf	71	— 4	Middle Plateau	48	+ 2
Ohio Valley and Tennessee	67	— 1	Northern Plateau	58	+ 2
Lower Lake	70	— 1	North Pacific	75	— 1
Upper Lake	71	— 1	Middle Pacific	60	— 6
North Dakota	67	+ 5	South Pacific	71	+ 2
Upper Mississippi Valley	69	+ 1			

WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Amarillo, Tex	7	54	n.	North Head, Wash	5	52	se.
Buffalo, N. Y	26	55	w.	Do	17	53	se.
Dodge, Kans	24	60	s.	Point Reyes Light, Cal.	1	57	nw.
Galveston, Tex	4	54	e.	Do	2	61	nw.
Lexington, Ky	25	52	sw.	Do	3	72	nw.
Little Rock, Ark	17	56	nw.	Do	4	75	nw.
Marquette, Mich	22	52	w.	Do	5	60	nw.
Modena, Utah	1	52	sw.	Do	6	70	nw.
Do	18	53	sw.	Do	7	55	nw.
Do	25	52	sw.	Do	10	63	nw.
Mount Tamalpais, Cal.	3	56	w.	Do	13	66	nw.
Do	6	53	nw.	Do	14	62	nw.
Do	10	50	nw.	Do	15	52	nw.
Do	13	59	nw.	Do	18	67	nw.
Do	18	68	nw.	Do	19	52	nw.
Do	24	60	sw.	Southeast Farallon, Cal.	14	55	nw.
Do	31	52	nw.	Do	15	50	nw.

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IV, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—Reports of 5131 thunderstorms were received during the current month as against 5690 in 1903 and 2498 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country was most numerous were: 25th, 417; 26th, 362; 30th, 318; 31st, 303; 24th, 282.

Reports were most numerous from: Missouri, 266; Ohio, 260; Nebraska, 256; Kansas, 243; Texas, 237.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the dates of full moon, viz, April 25 to May 3, inclusive, and May 25 to June 2, inclusive.

In Canada: Thunderstorms were reported from St. Johns, N. B., 27; Sydney, 27; Charlottetown, 20, 27; Quebec, 21; Montreal, 25; Ottawa, 22; Kingston, 25; Toronto, 23, 25, 26; Port Stanley, 13, 23, 26; Saugeen, 23, 25; Parry Sound, 23, 25, 26; Port Arthur, 6, 22, 29; Winnipeg, 21; Minnedosa, 26; Qu'Appelle, 2, 4, 27; Swift Current, 21, 28, 30; Edmonton, 21; Battleford 4.

Auroras were reported from Winnipeg, 14, 19; Swift Current, 12, 13, 16; Calgary, 12; Edmonton, 12, 13, 14, 17.

DESCRIPTION OF TABLES AND CHARTS.

By Mr. W. B. STOCKMAN, District Forecaster, in charge of Division of Meteorological Records.

For description of tables and charts see page 136 of REVIEW for March, 1904.

TABLE I.—*Climatological data for Weather Bureau stations, May, 1904.*

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.								Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.				Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.				Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.				
New England.							56.8	+ 2.9									76	3.18	— 0.4									4.9	
Eastport	76	69	82	29.91	29.99	+ .03	50.0	+ 2.5	75	4	58	33	2	42	38	46	43	83	2.23	— 1.5	12	8,930	s.	42	e.	16	7	13	11	6.2	
Portland, Me.	103	81	117	29.86	29.98	+ .01	56.1	+ 2.5	82	24	65	38	2	47	31	50	45	70	4.75	+ 1.2	12	7,368	s.	34	ne.	18	16	5	10	4.9	
Concord	298	70	79	29.66	29.98	.00	60.0	+ 3.4	86	26	72	34	3	48	44	...	...	...	4.02	+ 0.8	14	3,894	sw.	27	sw.	26	9	13	9	5.4	
Northfield	876	16	60	29.04	29.98	+ .01	57.1	+ 3.4	80	7	70	30	2	44	39	52	46	66	2.30	— 0.5	14	6,212	s.	35	nw.	25	11	12	8	5.5	
Boston	125	115	181	29.85	29.99	+ .01	60.8	+ 4.3	87	26	70	43	3	52	31	54	49	70	3.38	— 0.2	13	7,335	sw.	30	w.	16	14	9	8	4.8	
Nantucket	12	43	82	29.99	30.00	+ .01	55.2	+ 2.7	70	29	61	39	1	50	18	52	50	90	2.39	— 1.1	7	9,033	sw.	36	se.	9	11	17	3	4.7	
Block Island	26	11	46	29.97	30.00	+ .01	55.1	+ 2.7	69	29	61	39	3	49	20	52	50	86	2.40	— 1.4	9	10,712	sw.	36	nw.	27	17	10	4	3.9	
Narragansett	...	9	38	...	...	...	56.1	+ 1.5	72	*	64	35	3	48	26	...	...	...	4.20	+ 0.2	9	...	sw.	...	...	...	17	7	7	...	
New Haven	106	116	154	29.88	30.00	+ .01	60.9	+ 3.3	85	24	71	39	3	51	30	54	49	69	2.94	— 0.7	10	6,081	s.	26	sw.	5	18	7	6	3.5	
Mid. Atlantic States.							63.4	+ 1.9									68	2.23	— 1.4									4.6	
Albany	97	102	115	29.88	29.98	.00	62.6	+ 3.3	85	25	73	39	12	52	32	55	50	67	2.16	— 1.0	13	5,805	s.	30	s.	23	13	9	9	4.8	
Binghamton	875	79	90	29.06	29.99	+ .01	59.6	+ 2.8	88	25	71	31	12	48	39	...	...	...	2.66	— 1.4	10	4,309	e.	24	sw.	14	7	14	10	5.9	
New York	314	108	350	29.65	29.98	— .01	63.6	+ 4.1	86	26	72	45	12	55	28	56	52	72	1.61	— 1.6	7	8,113	s.	46	nw.	25	14	10	7	4.6	
Harrisburg	374	94	104	29.59	29.99	+ .01	63.8	+ 3.6	89	25	74	43	16	54	29	56	50	64	3.45	— 1.2	12	4,757	w.	30	sw.	15	7	17	7	5.3	
Philadelphia	117	116	184	29.88	30.00	+ .01	65.5	+ 3.5	90	25	75	44	3	56	27	56	50	63	2.08	— 1.1	8	6,987	sw.	28	nw.	27	18	6	7	4.1	
Scranton	805	111	119	29.19	29.99	+ .01	62.6	.....	91	25	74	38	12	52	39	54	48	62	2.17	.....	10	5,440	sw.	27	nw.	9	6	12	13	6.1	
Atlantic City	52	39	48	29.95	30.01	+ .03	59.3	+ 2.1	79	24	66	44	2	53	25	55	52	80	1.01	— 1.8	6	5,618	sw.	22	sw.	26	14	12	5	4.4	
Cape May	17	47	51	30.00	30.03	+ .04	59.8	+ 1.2	82	24	66	43	4	54	22	56	...	...	1.33	— 1.8	5	5,517	s.	21	s.	26	13	15	3	3.9	
Baltimore	123	69	117	29.85	29.98	— .01	65.7	+ 1.5	89	24	75	43	16	56	32	57	51	63	1.84	— 1.9	9	5,285	s.	35	sw.	19	11	14	6	5.0	
Washington	112	59	76	29.87	29.99	— .01	65.0	+ 1.1	89	25	76	43	5	54	35	58	52	66	2.64	— 1.3	7	4,621	s.	30	sw.	14	17	12	2	3.5	
Cape Henry	18	11	58	29.99	30.01	+ .01	64.4	— 0.1	87	26	71	50	4	57	24	...	...	...	2.62	— 1.4	7	8,997	se.	36	n.	9	12	11	8	4.3	
Lynchburg	681	83	88	29.25	29.99	— .01	65.2	— 0.8	90	25	77	40	16	54	36	58	53	67	2.76	— 1.2	8	3,225	se.	23	nw.	9	13	16	2	4.2	
Norfolk	91	102	111	29.91	30.01	+ .01	66.8	+ 0.4	90	24	76	50	4	58	31	59	54	69	2.62	— 1.7	8	6,556	s.	26	n.	27	11	12	8	4.9	
Richmond	144	82	90	29.85	30.00	+ .01	67.2	.....	91	25	78	46	16	56	33	...	...	...	1.45	.....	9	4,083	sw.	25	w.	9	21	8	2	2.5	
Wytheville	2,293	40	47	27.64	30.02	+ .03	59.4	.....	87	25	71	36	16	48	41	54	50	74	2.78	.....	15	3,594	nw.	26	w.	14	13	8	10	4.8	
S. Atlantic States.							69.7	— 0.2									68	2.09	— 1.9									3.8	
Asheville	2,255	53	75	27.68	29.98	— .01	61.6	— 1.0	86	25	73	38	12	50	40	53	47	61	3.17	— 0.4	11	6,177	se.	32	n.	9	11	18	2	4.6	
Charlotte	773	68	76	29.16	29.99	.00	68.8	+ 0.4	92	24	79	49	15	58	31	58	52	61	2.15	— 2.2	10	5,040	ne.	30	s.	30	16	7	8	3.9	
Hatteras	11	12	47	29.99	30.00	— .01	68.9	+ 2.5	83	31	75	54	13	63	22	64	62	79	2.80	— 1.8	9	9,138	ne.	36	n.	10	19	6	6	3.6	
Raleigh	376	71	79	29.59	29.99	.00	68.0	+ 0.5	91	24	79	49	16	57	30	59	54	68	2.76	— 1.7	13	4,820	sw.	24	nw.	27	13	12	6	4.7	
Wilmington	78	82	90	29.90	29.98	— .03	68.9	— 0.8	87	24	78	50	4	60	25	63	59	74	2.68	— 1.5	10	5,755	ne.	30	w.	18	15	13	3	3.8	
Charleston	48	14	92	29.94	29.99	— .02	72.2	— 0.2	90	27	79	59	16	65	25	64	61	72	1.46	— 2.6	6	8,003	s.	37	ne.	3	12	15	4	4.3	
Columbia, S. C.	351	167	175	29.60	29.98	— .02	71.4	— 1.0	93	24	82	52	15	61	29	61	54	61	1.00	— 2.9	8	7,376	e.	36	sw.	30	15	12	4	4.0	
Augusta	180	89	97	29.78	29.97	— .02	71.2	— 0.8	93	24	82	50	12	60	33	61	55	62	0.99	— 2.5	7	5,015	se.	40	w.	30	19	8	4	3.0	
Savannah	65	81	89	29.92	29.99	— .01	72.7	— 0.2	92	27	82	58	3	64	27	64	60	73	0.96	— 2.0	7	5,886	s.	25	sw.	31	15	13	3	3.7	
Jacksonville	43	101	129	29.91	29.96	— .04	73.0	— 1.9	92	28	81	59	16	65	22	66	62	74	2.90	— 1.1	6	6,559	e.	44	s.	31	17	13	1	2.8	
Florida Peninsula.							77.2	+ 0.1									75	6.53	+ 2.9									4.4	
Jupiter	28	10	48	29.91	29.94	— .04	77.3	+ 1.6	89	15	84	65	21	71	19	71	68	77	2.42	— 2.9	14	7,404	e.	30	w.	17	6	21	4	5.1	
Key West	22	10	53	29.91	29.93	— .04	77.6	— 1.8	85	31	82	69	2	73	13	72	69	76	13.01	+ 9.8	12	6,018	e.	32	sw.	19	13	13	5	4.3	
Sand Key	25	40	71	29.89	29.92	.....	79.0	.....	92	27	83	69	5	75	15	...	...	...	9.41	.....	9	8,928	e.	37	ne.	5	13	8	10	5.2	
Tampa	34	60	67	29.91	29.94	— .05	76.6	+ 0.6	94	28	87	62	1	66	27	68	64	71	4.17	+ 1.7	5	4,199	ne.	24	ne.	5	17	12	2	3.2	
East Gulf States.							71.1	— 1.3									65	2.66	— 1.6									3.6	
Atlanta	1,174	190	216	28.75	29.97	— .02	68.4	— 0.4	89	24	78	47	15	59	24	58	50	56	2.52	— 0.7	6	8,714	s.	32	nw.	14	16	8	7	4.3	
Macon	370	93	99	29.59	29.98	— .01	70.6	.....	93	27	82	47	16	59	34	...	...	...	1.83	.....	8	4,743	s.	29	w.	30	13	9	9	4.6	
Pensacola	56	79	96	29.91	29.97	— .02	72.8	— 0.7	88	22	80	58	19	66	22	...	...	...	1.03	— 2.3	8	7,533	ne.	35	sw.	30	19	11	1	2.9	
Birmingham	700	136	143	29.23	29.98	.00	69.7	— 3.2	92	24	80	48	15	59	31	...	...	...	2.19	— 1.7	8	5,974	sw.	33	w.	30	18	10	3	3.1	
Mobile	57	88	96	29.91	29.97	— .02	71.8	— 1.8	90	28	81	54	2	63	28	64	60	70	2.12	— 2.2	8	5,491	s.	24	s.	29	14	15	2	3.4	
Montgomery	223	100	112	29.72	29.95	— .04	71.8	— 1.0	94	28	83	50	16	61	32	62	57	63	3.47	— 0.6	7	4,923	n.	30	w.	30	16	12	3	3.5	
Meridian	375	84	93	29.58	29.96	— .02	69.0	— 1.4	90	23	81	44	15	57	36	...	...	...	2.82	— 2.0	7	3,773	nw.	27	w.	30	16	13	2	3.5	
Vicksburg	247	62	74	29.68	29.93	— .04	71.4	— 1.2	90	27	81	54	2	62	26	63	58	67	2.80	— 2.1	9	4,686	e.	37	nw.	1	15	9	7	3.8	
New Orleans	51	88	121	29.91	29.96	— .01	74.2	— 0.4	89	27	82	57	2	66	23	66	61	69	4.31	— 0.6	6	6,081	se.	26	se.	6	18	8	5	3.3	
West Gulf States.							71.7	— 0.9									71	4.16	— 0.2									4.4	
Shreveport	249	77	84	29.68	29.95	.00	71.8	— 1.3	90	26	82	52	15	62	26	62	58	67	3.54	— 0.6	10	4,833	se.	45	se.	4	12	15	4	4.3	
Fort Smith	457	79	94	29.45	29.92	— .01	67.0	— 1.2	90	23	77	47	10	57	30	60	55	68	4.38	— 0.4	12	5,937	e.	38	w.	5	8	18	5	4.9	
Little Rock	357	93	100	29.57	29.94	— .01	68.4	— 0.9	89	23	78	48	15	59	28	60	54	65	3.04	— 2.7	8	5,250	nw.	56	nw.	17	13	9	9	4.5	
Corpus Christi	20	48	53	29.89	29.91	+ .01	75.4	0.0	92	30	80	61	6	70	23	70	68	79	3.04	— 0.2	13	9,151	se.	43	ne.	2	14	11	6	4.3	
Fort Worth	670	106	114	29.23	29.93	+ .02	71.6	.....	90	23	82	52	10	61	26	...	...	...	3.86	.....	4	8,501	s.	48	nw.	5	21	9	1	3.2	
Galveston	54	106	112	29.89	29.95	+ .01	74.4	— 1.4	85	31	78	61	6	70	15	68	66	78	5.20	+ 1.4	6	8,338	s.	54	e.	4	13	16	2	3.7	
Palestine	510	73	79	29.41	29.94	+ .01	71.2	— 0.1	90	26	81	51	15	62	27	64	60	72	3.97	— 1.9	6	4,834	s.	35	nw.	6	13	14	4	4.5	
San Antonio	701	80	91	29.18	29.90	.00	73.6	— 1.3	94	31	84	52	10	63	29	65	61	70	5.93	+ 2.7	12	5,075	se.	38	nw.	17	13	13	5	4.1	
Taylor	583	55	63	29.31	29.92	+ .01	72.1	.....	92	26	83	50	10	62	28	...	...	...	9.09	.....	10	6,759	s.	39	nw.	3	5	17	9	6.2	
Ohio Val. and Tenn.							64.9	— 0.2									67	3.20	— 0.6									5.1	
Chattanooga	762	106	112	29.19	29.99	.00	67.1	— 0.6	93	24	78	45	15	56	33	57	50	59	2.76	— 1.1	11	5,194	w.	37	sw.	29	15	10	6	4.3	
Knoxville	1,004	35	88	28.93	29.97	— .02	66.2	0.0	92	24	78	43	15	54	33	56	50	62	2.34	— 1.6	9	4,871	sw.	42	sw.	30	14	12	5	4.0	
Memphis	397	146	154	29.55	29.97	+ .01	68.7	— 1.5	89	23	77	51	15	60	25	61	57	71	4.91	+ 0.4	11	6,836	nw.	38	sw.	30	13	9	9	4.8	
Nashville	546	122	134	29.40	29.98	.00	66.6	— 1.7	92	24	77	41	15	56	33	58	53	65	2.97	— 0.6	12	4,871	nw.	43	sw.	29	14	7	10	4.8	
Lexington	989	75	102	28.91	29.96	— .03	63.8	+ 0.8	89	25	73	40	15	54	28	...	...	...	2.60	— 0.9	14	7,512	se.	52	sw.	25	15	7	9	4.3	
Louisville	525	114	136	29.40	29.98	.00	66.2	+ 0.1	92	25	76	45	15	56	31	58	54	69	1.77	— 2.0	12	5,842	se.	41	sw.	29	6	13	12	5.8	
Evansville	431	72	82	29.49	29.95	— .02	65.9	.....	89	24	75	46	15	57	25	...	...	...	2.01	.....	14	5,066	n.	38	sw.	29	12	14	5	4.6	
Indianapolis	822	154	164	29.08	29.96	— .01	61.7	— 1.5	86	25	71	38	16	53	30	55	50	70	3.75	— 0.4	14	7,878	s.	37	sw.	22	11	11	9	5.7	
Cincinnati	628	152	160	29.29	29.96	— .03	64.2	— 0.5	90	25	74	41	16	55	29	55	49	63	3.70	+ 0.3	15	5,124	se.	26	w.	9	4	18	9	6.3	
Columbus	824	173	190	29.09	29.96	— .02	62.1	+ 0.1	90	25	72	37	16	52	31	54	49	69	4.01	— 0.2	15	8,377	sw.	46	sw.	9	8	12	11	5.6	T.
Pittsburg	842	116	123	29.07	29.97	— .02	64.0	+ 1.8	91	25	74	41	15	54	33	55	49	64	3.48	+ 0.1	14	4,017	nw.	25	s.	31	9	12	10	5.8	
Parkersburg	638	77	84	29.32	30.00	+ .01	63.8	+ 0.8	92	25	75	35	16	53	38	56	51	66	2.93	— 0.5	10	4,087	se.	28	nw.	9	10	13	8	4.9	
Elkins	1,940	41	50	27.96	29.99	— .01	58.4	.....	89	25	72	32	12	45	45	53	49	75	3.60	.....	17	2,998	s.	26	w.	14	9	10	12	6.0	
Lower Lake Region.							58.6	+ 1.8									70	3.10	— 0.3									5.5	
Buffalo	767	178	206	29.13	29.96	— .01	57.1	+ 3.1	81	13	65	39	11	49	31	52	49	79	3.12	— 0.3	13	9,000	sw.	55	w.	26	7	6	18	6.7	
Oswego	335	76	91	29.60	29.96	— .01	56.7	+ 2.7	84	25	66	36	12	47	33	51	46	70	2.48	— 0.4	13	6,362	s.	28	w.	25	9	13	9	4.6	
Rochester	523	81	102	29.40	29.97	.00	59.8	+ 3.5	88	25	70	36	12	50	39	53	48	68	3.86	+ 0.5	15	5,521	sw.	31	sw.	26	7	12	12	5.8	
Syracuse	597	97	113	29.34	29.98	.00	60.1	.....	86	25	69	35	12	51	34	...	...	...	3.40	.....	13	7,966	s.	44	nw.	25	6	16	9	5.5	
Erie	713	92	102	29.19	29.96	— .02	58.2	+ 1.5	86	25	66	38	2	50	33	52	47	70	3.40	— 0.4	13	7,032	w.	31	sw.	25	10	7	14	6.0	
Cleveland	762	190	201	29.14	29.96	— .02	58.6	+ 0.9	88	25	66	39	1	51	30	53	48	71	3.70	+ 0.1	14	9,826	se.	45	sw.	13	16	8	7	4.7	
Sandusky	629	62	70	29.27	29.95	— .03	59.2	+ 0.7	90	25	67	37	16	51	29	...	...	...	3.18	— 0.3	11	6,099	sw.	29	nw.	26	13	8	10	4.8	
Toledo	628	120	127	29.27	29.95	— .02	59.8	+ 0.4	89	25	69	35	16	51	30	52	46	66	2.69	— 0.7	12	7,891	w.	40	sw.	26	13	11	7	4.9	
Detroit	730	153	193	29.15	29.94	— .03	59.2	+ 1.7	88	25	68	38	11	50	30	52	46	66	2.36	— 1.2	14	8,431	sw.	38	sw.	9	7	10	14	6.1	
Upper Lake Region.							53.2	+ 1.6									71	3.85	+ 0.5									5.9	
Alpena	609	63	80	29.28	29.94	— .03	51.9	+ 2.9	79	29	62	28	11	42	37	47	43	75	3.77	+ 0.3	16	7,115	se.	44	nw.	9	8	10	13	5.8	T.
Escanaba	612	40	48	29.28	29.94	— .03	50.4	+ 1.1	78	21	60	29	11	41	29	45	40	74	6.62	+ 3.2	15	5,744	n.	31	nw.	29	8	9	14	5.9	0.2
Grand Rapids	707	127	165	29.17	29.94	— .02	58.4	— 0.1	84	25	68	34	11	48	32	52	47	68	4.14	+ 0.7	11	8,279	sw.	40	nw.	22	6	12	13	6.1	
Houghton	668	66	74	29.21	29.94	— .03	50.3	.....	81	21	61	30	11	40	39	...	...	...	2.57	.....	13	5,560	e.	30	n.	9	15	6	10	4.9	2.5
Marquette	734	76	116	29.16	29.96	— .01	50.2	+ 1.2	80	29	59	31	10	41	40	43	36	64	5.53	+ 2.6	16	7,458	nw.	52	w.	22	6	11	14	6.7	2.4
Port Huron	638	70	120	29.27	29.97	.00	56.4	+ 3.2	87	25	66	36	11	47	34	50	46	72	1.82	— 1.6	12	7,837	sw.	33	sw.	9	8	10	13	5.9	
Sault Ste. Marie	614	40	61	29.24	29.91	— .04	49.2	+ 1.4	78	5	59	28	11	39	39	45	41	76	4.71	+ 2.5	16	5,804	w.	37	nw.	9	11	5	15	6.1	0.6
Chicago	823	241	274	29.08	29.96	.00	57.3	+ 1.2	87	25	65	38	15	49	29	50	45	69	1.54	— 2.2	11	11,828	ne.	42	sw.	22	8	12	11	5.9	
Milwaukee	681	124	142	29.22	29.96	.00	55.0	+ 2.1	84	22	64	37	16	46	26	48	43	71	2.38	— 1.2	12	7,483	ne.	38	ne.	9	8	9	14	6.2	
Green Bay	617	49	86	29.28	29.94	— .01	54.9	+ 1.0	82	21	65	32	15	45	33	49	45	73	6.53	+ 3.2	16	8,258	n.	38	ne.	29	8	10	13	5.9	
Duluth	1,133	11	47	28.74	29.96	.00	48.8	+ 1.8	78	20	57	29	16	40	29	43	37	67	1.48	— 2.2	8	9,392	ne.	43	ne.	11	10	7	14	5.2	T.

TABLE I.—*Climatological data for Weather Bureau stations, May, 1904*—Continued.

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.								Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.				Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.				Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.				
North Dakota.							**54.1**	**+ 0.5**									**67**	**1.42**	**— 0.9**									**5.3**	
Moorhead	935	54	60	28.93	29.95	+ .01	55.2	+ 2.0	82	20	66	34	13	44	33	48	42	66	2.22	— 0.3	9	7,100	se.	41	se.	11	15	6	10	4.6	
Bismarck	1,674	16	29	28.16	29.94	+ .02	53.8	— 0.4	84	28	65	32	14	43	35	48	43	71	0.77	— 1.7	13	8,064	n.	40	s.	4	10	13	8	5.4	
Williston	1,875	14	44	27.93	29.90	— .03	53.2	0.0	83	21	66	26	9	40	39	46	39	64	1.27	— 0.8	8	8,441	se.	46	n.	12	6	12	13	6.0	
Upper Miss. Valley.							**61.5**	**+ 0.1**									**69**	**3.49**	**— 0.7**									**5.0**	
Minneapolis		99	208				57.6	+ 0.8	84	22	67	35	14	48	30				3.54	— 0.2	10	8,924	w.	34	e.	11	6	12	13		
St. Paul	837	102	122	29.02	29.93	— .01	58.2	+ 0.7	85	22	68	37	15	48	29	49	42	61	3.20	— 0.2	10	5,631	nw.	25	se.	11	12	8	11	5.0	
La Crosse	714	71	87	29.18	29.95	+ .01	59.6	+ 0.2	86	22	70	36	15	50	29				3.57	+ 0.3	10	5,354	n.	26	nw.	9	12	13	6	4.6	
Davenport	606	71	79	29.28	29.91	— .04	61.4	+ 0.7	84	22	71	40	15	51	31	54	50	68	2.64	— 1.7	12	5,582	nw.	27	s.	11	11	12	8	5.0	
Des Moines	861	84	99	29.04	29.96	+ .03	60.6	+ 0.2	85	24	71	38	14	50	35	54	49	70	3.16	— 1.5	9	6,240	se.	40	sw.	11	8	16	7	5.6	
Dubuque	698	100	117	29.20	29.95	.00	60.2	+ 0.3	86	22	70	39	16	50	31	53	48	66	3.86	— 0.1	8	5,092	nw.	34	nw.	22	12	15	4	4.4	
Keokuk	614	63	78	29.27	29.92	— .02	62.4	— 0.2	85	*	71	43	14	53	32	55	51	72	3.94	— 0.1	14	5,692	sw.	32	sw.	28	14	8	9	4.4	
Cairo	356	87	93	29.58	29.96	.00	67.0	— 0.1	89	24	75	48	15	58	23	60	56	73	2.03	— 1.8	11	5,837	s.	34	nw.	9	5	17	9	5.9	
Springfield, Ill	644	82	93	29.26	29.94	— .01	62.1	— 0.3	86	25	72	45	14	52	30	56	51	72	3.74	— 1.2	13	7,105	s.	29	s.	6	11	8	12	5.5	
Hannibal	534	75	109	29.35	29.92	— .02	62.8	— 0.3	87	24	72	43	15	54	28				5.84	+ 0.5	14	7,094	nw.	38	sw.	22	15	9	7	4.3	
St. Louis	567	208	217	29.33	29.93	— .02	65.1	— 0.7	90	24	74	47	15	57	29	57	52	68	2.88	— 1.7	15	8,318	s.	39	s.	25	11	13	7	4.8	
Missouri Valley.							**60.8**	**+ 0.7**									**64**	**4.34**	**+ 0.2**									**5.6**	
Columbia, Mo	784	11	84	29.11	29.94	.00	62.6	— 1.9	87	24	73	43	15	53	31				5.39	+ 0.4	14	5,840	s.	27	sw.	22	8	11	12	5.5	
Kansas City	963	78	95	28.93	29.96	+ .04	63.2	— 1.0	86	22	72	42	14	55	28	56	51	72	10.70	+ 6.1	16	6,067	nw.	34	s.	11	15	8	8	4.7	
Springfield, Mo	1,324	98	104	28.55	29.94	+ .01	63.4	+ 0.2	85	23	71	43	14	55	24	56	52	71	2.95	— 3.0	16	7,527	nw.	35	nw.	17	16	9	6	4.1	
Topeka		85	89				62.2	— 1.2	85	22	71	39	14	53	31				6.96	+ 2.0	13	7,016	s.	33	sw.	11	10	10	11	5.3	
Lincoln	1,189	75	84	28.66	29.91	.00	60.8	— 0.3	89	24	71	36	14	51	34	53	48	67	4.20	— 0.2	13	7,769	s.	43	n.	24	9	11	11	5.7	
Omaha	1,105	115	121	28.76	29.92	.00	62.0	+ 0.3	88	24	71	38	14	53	34	53	47	62	4.86	+ 0.5	11	6,419	n.	32	n.	8	10	8	13	5.9	
Valentine	2,598	47	54	27.24	29.93	+ .03	57.3	+ 1.5	87	30	69	33	*	45	44	48	41	59	2.93	+ 0.1	10	8,265	nw.	39	nw.	12	8	6	17	6.2	
Sioux City	1,135	96	164	28.72	29.93	+ .01	60.2	+ 1.8	88	22	71	37	14	50	34				3.09	— 0.6	12	9,844	nw.	41	s.	4	5	10	16	7.0	
Pierre	1,572	43	50	28.26	29.92	+ .01	59.8	+ 4.2	87	22	71	34	14	48	37	50	41	56	0.62	— 1.7	10	7,046	nw.	38	nw.	11	5	12	14	6.5	
Huron	1,306	56	67	28.54	29.94	+ .02	57.2	+ 2.1	85	22	70	34	9	45	35	50	43	65	3.18	+ 0.2	9	9,731	se.	42	s.	30	9	12	10	5.9	
Yankton	1,233	42	49	28.64	29.94	+ .02	60.2	+ 1.7	91	22	72	36	14	48	43				2.86	— 1.5	12	6,218	e.	40	w.	8	15	10	6	4.6	
Northern Slope.							**53.6**	**+ 0.1**									**64**	**3.38**	**+ 1.1**									**4.5**	
Havre	2,505	11	44	27.30	29.92	+ .02	54.2	+ 0.9	84	21	66	26	13	42	43	46	39	63	2.24	+ 0.7	12	7,486	sw.	44	w.	29	13	15	3	4.4	6.2
Miles City	2,371	42	50	27.39	29.89	— .02	56.2	— 0.2	80	29	67	33	13	45	36	51	48	79	1.96	— 0.3	5	5,870	nw.	34	nw.	11	10	16	5	4.9	
Helena	4,110	88	94	25.78	29.95	+ .02	51.8	0.0	78	21	62	30	11	42	38	42	31	50	1.20	— 0.4	9	6,494	sw.	37	w.	29	6	15	10	5.9	1.1
Kalispell	2,965	45	51	26.89	29.94	+ .06	51.6	.....	79	21	63	27	8	40	39	43	34	60	0.79	.....	13	4,629	w.	27	sw.	7	11	17	3	4.3	
Rapid City	3,234	46	50	26.55	29.90	.00	53.8	+ 0.9	79	29	64	32	14	43	38	48	44	73	3.50	— 0.1	16	6,395	w.	37	nw.	6	12	5	14	5.9	T.
Cheyenne	6,088	56	64	23.97	29.90	+ .05	49.2	— 1.4	77	24	61	26	13	38	37	41	35	64	6.66	+ 4.4	15	7,834	n.	42	nw.	7	5	15	11	6.5	1.7
Lander	5,372	26	36	24.60	29.91	+ .03	51.0	0.0	81	18	64	28	8	38	40	43	36	64	4.49	+ 2.2	10	3,301	nw.	32	w.	10	2	23	6	6.2	0.6
Yellowstone Park	6,200	11	47	23.84	29.93	+ .02	45.3	.....	70	18	57	20	26	33	40	37	29	60	1.31	.....	15	6,418	nw.	38	nw.	29	6	19	6	5.9	2.7
North Platte	2,821	43	52	27.03	29.93	+ .05	58.8	+ 0.6	92	24	72	32	13	46	38	50	44	66	3.63	+ 0.9	12	7,849	nw.	34	nw.	12	9	17	5	5.5	
Middle Slope.							**61.4**	**— 0.6**									**66**	**4.19**	**+ 0.6**									**5.6**	
Denver	5,291	79	151	24.67	29.88	+ .04	56.2	— 0.2	83	24	68	35	9	45	37	47	40	61	3.27	+ 0.4	10	6,248	s.	48	w.	7	4	20	7	6.0	
Pueblo	4,685	80	86	25.22	29.86	+ .03	57.6	— 1.1	86	24	70	34	9	45	38	46	37	55	1.95	+ 0.1	9	5,633	se.	41	n.	12	10	15	6	5.1	
Concordia	1,398	42	47	28.46	29.93	+ .02	61.8	— 0.3	85	24	72	38	14	52	33	54	49	66	5.45	+ 1.4	13	5,702	se.	30	s.	24	6	19	6	5.5	
Dodge	2,509	44	54	27.33	29.90	+ .03	62.5	— 0.4	88	24	75	37	13	50	37	55	50	70	4.42	+ 1.2	12	9,585	se.	60	s.	24	11	6	14	5.8	
Wichita	1,358	78	86	28.52	29.94	+ .04	63.4	— 0.8	87	23	73	40	14	54	30	56	52	73	5.74	+ 1.5	15	5,929	se.	28	ne.	7	11	10	10	5.5	
Oklahoma	1,214	79	86	28.64	29.90	+ .01	66.8	— 1.0	88	23	77	47	14	57	28	58	53	68	4.31	— 1.2	14	8,874	se.	36	n.	8	5	20	6	5.4	
Southern Slope.							**69.0**	**— 0.2**									**59**	**2.54**	**— 0.8**									**3.9**	
Abilene	1,738	45	54	28.09	29.86	— .01	71.5	— 0.7	94	31	83	48	9	60	35	60	52	58	2.20	— 1.4	5	7,811	se.	36	nw.	12	9	16	6	4.7	
Amarillo	3,676	10	49	26.18	29.85	+ .01	64.4	+ 0.2	92	31	78	41	9	51	40	53	44	60	2.88	— 0.3	10	10,931	se.	54	n.	7	22	7	2	2.9	
Southern Plateau.							**66.9**	**+ 0.4**									**32**	**0.47**	**— 0.1**									**2.7**	
El Paso	3,762	10	110	26.08	29.76	— .02	71.2	— 1.1	96	30	85	43	4	57	42	51	31	28	0.06	— 0.4	3	8,618	nw.	48	sw.	24	21	8	2	2.3	
Santa Fe	7,013	47	50	23.21	29.78	— .03	56.6	+ 0.9	77	30	68	29	3	45	32	42	28	39	0.79	— 0.3	11	6,658	se.	46	se.	2	17	14	0	3.4	T.
Flagstaff	6,907	12	25	23.29	29.77	— .01	51.7	— 2.6	77	17	67	20	2	36	48	38	25	42	1.90	+ 0.7	3	7,448	sw.	40	sw.	26	14	13	4	4.3	15.0
Phoenix	1,108	50	56	28.62	29.75	— .03	77.0	+ 2.6	100	17	92	49	2	62	40	54	30	22	T.	— 0.1	0	4,139	e.	27	sw.	1	23	7	1	2.2	
Yuma	141	16	46	29.60	29.75	— .04	77.2	+ 0.1	101	17	93	50	2	62	39	58	42	36	0.07	0.0	1	5,122	s.	37	w.	1	28	2	1	0.8	
Independence	3,910	51	58	25.87	29.79	— .05	67.6	+ 2.2	88	12	80	43	1	55	36	48	24	22	0.02	— 0.3	1	8,315	nw.	48	nw.	1	23	3	5	3.1	
Middle Plateau.							**57.6**	**+ 0.6**									**48**	**1.22**	**+ 0.2**									**4.2**	
Carson City	4,720	82	92	25.24	29.90	— .01	55.6	+ 1.4	82	23	70	28	1	41	44	44	34	51	0.10	— 0.5	1	5,577	nw.	36	sw.	24	18	10	3	3.2	T.
Winnemucca	4,344	59	70	25.57	29.91	.00	55.6	+ 1.2	82	23	71	29	3	40	41	44	33	49	0.30	— 0.7	2	7,078	nw.	42	nw.	18	19	4	8	4.1	T.
Modena	5,479	10	43	24.52	29.79	— .03	56.4	.....	82	17	71	31	9	42	44	43	29	44	1.55	.....	10	8,257	w.	53	sw.	18	14	11	6	4.1	2.4
Salt Lake City	4,366	105	110	25.52	29.85	— .01	57.5	— 0.3	83	17	68	36	8	47	34	46	35	49	3.08	+ 1.4	8	5,083	n.	34	nw.	25	5	18	8	5.4	
Grand Junction	4,608	43	51	25.26	29.79	— .04	61.8	+ 0.2	88	23	75	36	8	49	35	48	36	45	1.39	+ 0.8	8	4,328	nw.	29	s.	19	14	13	4	4.3	
Northern Plateau.							**57.1**	**— 0.2**									**58**	**0.43**	**— 1.2**									**5.2**	
Baker City	3,471	53	59	26.44	30.01	+ .05	52.6	— 0.1	78	21	64	28	5	41	35	43	33	52	0.82	— 1.1	6	5,555	nw.	27	nw.	25	6	10	15	6.2	
Boise	2,739	61	68	27.11	29.95	+ .01	58.6	+ 0.5	83	23	72	32	5	46	36	49	43	60	0.02	— 1.6	1	4,257	nw.	24	nw.	19	14	7	10	4.7	
Lewiston	757	52	61	29.18	29.99	+ .03	60.6	+ 0.3	85	21	73	37	25	48	38				0.58	— 1.5	7	3,760	e.	33	nw.	23	13	11	7	4.3	
Pocatello	4,482	46	54	25.41	29.88	— .01	55.6	+ 1.3	78	22	67	30	8	44	43	46	36	51	0.40	— 0.8	9	7,498	w.	34	ne.	20	8	19	4	4.8	
Spokane	1,929	101	110	27.96	30.00	+ .04	55.6	— 1.4	80	20	67	33	5	44	35	45	34	51	0.13	— 1.3	5	5,858	s.	30	sw.	4	5	8	18	7.3	
Walla Walla	1,000	65	71	28.94	30.01	+ .05	59.4	— 1.5	86	21	71	38	25	48	37	54	50	74	0.61	— 1.1	7	4,195	s.	22	sw.	6	13	17	1	3.9	
N. Pac. Coast Reg.							**53.2**	**— 0.6**									**75**	**1.14**	**— 1.7**									**5.4**	
North Head	211	11	56	29.90	30.13	+ .10	50.7	— 1.9	77	12	54	39	4	47	23	49	47	90	0.90	— 2.3	11	12,400	nw.	53	se.	17	8	13	10	5.8	
Port Crescent	259	12	29	29.83	30.12	+ .10	47.8	— 2.6	71	12	55	31	1	40	29				0.73	— 1.8	10	3,794	w.	16	ne.	12	12	7	12	5.3	
Seattle	123	114	151	29.98	30.11	+ .10	55.1	— 0.2	81	12	64	41	5	47	30	48	43	69	0.34	— 2.0	8	4,617	n.	32	sw.	17	12	9	10	5.3	
Tacoma	213	113	120	29.85	30.08	+ .06	53.6	— 0.5	79	12	63	36	5	44	33				1.04	— 1.5	7	4,296	n.	22	sw.	6	13	9	9	5.2	
Tatoosh Island	86	7	57	30.00	30.10	+ .09	49.9	— 0.1	64	12	54	39	5	46	22	47	45	86	3.37	— 1.2	12	8,626	w.	42	w.	3	7	8	16	6.6	
Portland, Oreg	154	68	96	29.92	30.08	+ .05	57.6	+ 0.3	81	12	68	38	5	48	34	49	42	64	0.59	— 1.8	9	4,123	nw.	27	ne.	24	10	7	14	5.7	
Roseburg	518	56	60	29.52	30.08	+ .05	58.0	+ 1.1	84	21	71	38	15	45	40	49	43	65	0.99	— 1.0	6	2,923	n.	21	n.	24	14	11	6	4.2	
Mid. Pac. Coast Reg.							**60.7**	**+ 2.2**									**60**	**0.36**	**— 1.2**									**2.8**	
Eureka	62	62	80	30.01	30.08	+ .03	52.6	— 0.9	66	21	57	42	5	48	19	49	46	80	1.02	— 1.8	4	6,636	n.	43	n.	25	17	8	6	3.6	
Mount Tamalpais	2,375	11	18	27.50	29.95	— .05	61.2	.....	85	22	69	34	1	54	32	48	36	48	0.39	.....	2	15,395	nw.	68	nw.	18	23	5	3	2.3	
Red Bluff	332	50	56	29.54	29.86	— .09	71.4	+ 4.4	101	23	84	43	1	59	36	56	42	41	0.04	— 1.3	1	5,429	n.	44	nw.	25	25	4	2	1.4	
Sacramento	69	106	117	29.80	29.87	— .07	67.6	+ 4.1	97	22	79	46	1	56	31	57	49	56	0.03	— 0.9	1	7,517	s.	36	nw.	7	24	6	1	1.8	
San Francisco	155	161	167	29.80	29.98	— .01	59.0	+ 2.4	86	8	66	45	1	52	27	52	48	75	0.30	— 0.4	1	8,921	w.	42	w.	16	24	6	1	2.1	
Point Reyes Light	490	7	50	.....	.....	.....	52.9	+ 0.7	74	8	58	41	1	48	25	.....	.....	.....	0.42	— 1.5	3	20,404	nw.	75	nw.	4	15	4	12	4.6	
Southeast Farallon	30	9	17	29.94	29.97	.....	52.8	.....	64	26	55	46	1	51	10	...	.....	.....	0.23	.....	1	14,993	nw.	55	nw.	14	17	5	9	4.1	
S. Pac. Coast Reg.							**63.0**	**+ 0.6**									**71**	**0.11**	**— 0.2**									**3.8**	
Fresno	330	67	70	29.51	29.85	— .07	71.4	+ 3.4	102	23	87	41	2	56	39	56	43	43	0.12	— 0.2	1	5,391	nw.	28	nw.	18	28	2	1	1.4	
Los Angeles	338	116	123	29.54	29.91	— .04	62.2	+ 0.1	80	8	71	45	3	54	26	55	52	79	T.	— 0.4	0	4,129	w.	36	w.	1	5	19	7	5.6	
San Diego	87	94	102	29.81	29.90	— .05	60.5	+ 0.1	69	19	65	48	3	56	14	56	53	80	0.12	— 0.2	3	4,153	sw.	27	w.	1	15	6	10	4.5	
San Luis Obispo	201	47	54	29.72	29.94	— .06	58.0	— 1.0	84	16	68	42	26	48	36	53	50	81	0.20	— 0.1	2	4,012	w.	20	w.	1	18	8	5	3.6	
West Indies.																														
Basseterre	29	41	54	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Bridgetown	30	57	65	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cienfuegos	52	62	67	...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Grand Turk	11	6	20	29.93	29.94	— .06	80.1	.....	89	10	86	66	25	74	18	.....	.....	.....	10.73	.....	16	.....	se.	.....	.....	.....	6	13	12	6.3	
Hamilton	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Havana	57	87	105	29.85	29.91	— .03	77.4	— 1.4	88	8	84	68	1	71	18	.....	.....	.....	13.84	+ 9.4	14	6,380	e.	30	e.	5	20	2	9	3.9	
Puerto Principe	352	55	62	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
San Juan	82	48	90	29.88	29.96	— .03	78.8	— 0.6	89	17	85	70	14	73	16	73	70	77	5.03	+ 0.4	16	7,915	se.	29	se.	8	6	16	9	6.0	

* More than one date.

TABLE II.—*Climatological record of voluntary and other cooperating observers, May, 1904.*

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Alabama.	°	°	°	*Ins.*	*Ins.*
Anniston	96	41	67.6	3.52	
Ashville	94	39	67.0	1.92	
Benton	.....	.....	.....	3.58	
Bermuda	95	42	70.6	1.84	
Boligee	95	43	70.6	2.48	
Bridgeport	.....	.....	.....	4.16	
Burkeville	.....	.....	.....	3.50	
Calera	.....	.....	.....	1.86	
Camphill	97	45	71.2	5.50	
Cedar Bluff	.....	.....	.....	3.28	
Citronelle	90	52	72.1	5.09	
Clanton	95	45	70.0	1.54	
Cordova	95	39	67.4	2.67	
Daphne	91	54	72.8	1.30	
Decatur	96	45	69.2	3.04	
Demopolis	.....	.....	.....	2.16	
Dothan	99	50	73.9	3.78	
Eufaula	94	45	70.6	1.37	
Evergreen	93	45	71.2	2.43	
Flomaton	95[1]	44[1]	69.5[1]	3.92	
Florence *a*	.....	.....	.....	3.66	
Florence *b*	95	41	68.0	4.47	
Fort Deposit	94	48	71.2	3.24	
Gadsden	98	42	68.6	2.72	
Goodwater	97	44	69.4	2.69	
Greensboro	91	50	71.2	3.00	
Greenville	.....	.....	.....	3.80	
Hamilton	93	39	67.4	2.85	
Highland Home	90	47	70.2	1.96	
Letohatchie	.....	.....	.....	3.42	
Livingston	93	47	70.0	2.66	
Lock No. 4	96	42	68.2	4.03	
Madison Station	98	42	70.2	2.71	
Maplegrove	96	39	66.6	3.00	
Marion	95	48	72.0	2.82	
Milstead	.....	.....	.....	3.52	
Newbern	96	44	71.8	2.94	
Notasulga	.....	.....	.....	3.46	
Oneonto	94	37	66.7	2.83	
Opelika	98	47	72.4	3.05	
Ozark	97	48	72.5	0.66	
Prattville	95	41	69.6	3.31	
Pushmataha	91	44	69.0	2.26	
Riverton	95	39	67.5	4.59	
Scottsboro	94	39	66.2	4.88	
Selma	95	50	73.4	2.21	
Spring Hill	91	56	72.2	.....	
Talladega	98	42	69.6	3.01	
Tallassee	.....	.....	.....	3.23	
Thomasville	97	48	72.4	3.72	
Tuscaloosa	94	45	70.4	1.24	
Tuscumbia	94	45	68.4	3.63	
Tuskegee	96	49	72.8	4.70	
Union Springs	94	49	72.2	1.85	
Uniontown	93	45	70.2	4.18	
Valleyhead	95	38	66.0	4.09	
Verbena	.....	.....	.....	2.32	
Wetumpka	98	44	71.6	3.16	
Alaska.					
Juneau	65	30	46.5	6.50	
Sitka	57	33	44.4	3.80	
Teikhill	.....	16	.....	0.40	
Arizona.					
Agua Caliente	103	47	78.6	0.00	
Allaire Ranch	.....	.....	.....	0.61	
Arizona Canal Co's Dam	101	49	79.2	0.00	
Aztec	107	48	84.8	0.00	
Bisbee	89	41	66.3	1.12	
Blue	93	25	60.6	0.24	T.
Bowie	98	31	67.4	0.46	
Buckeye	98[4]	54[4]	76.3[4]	0.00	
Casagrande	106	46	78.1	0.00	
Cochise *[1]	105	50	75.6	0.70	
Congress	93	39	73.8	T.	
Douglas	96	34	69.6	0.51	
Dragoon *[1]	86	63	73.0	0.00	
Dudleyville	99	41	71.3	0.66	
Duncan	96	29	64.2	0.55	
Fort Apache	90	29	60.8	0.20	
Fort Defiance	78	24	51.8	1.90	
Fort Grant	107	35	67.1	0.40	
Fort Huachuca	90	38	67.6	1.39	
Fort Mohave	106	48	79.8	0.50	
Gilabend	.....	.....	.....	0.09	
Grand Canyon	77	.....	.....	0.00	
Greaterville	92	32	65.2	1.33	
Holbrook	89	30	61.4	0.61	2.5
Jerome	89	33	67.8	0.50	
Kingman	93	33	67.3	0.22	
Maricopa	104	47	77.0	T.	
Mesa	102	45	76.4	T.	
Mohawk Summit *[1]	106	69	86.8	0.00	
Natural Bridge	.....	.....	.....	0.90	1.0
Oracle	89	35	70.4	1.25	T.
Oro	.....	.....	.....	0.73	
Parker	106	46	79.2	2.00	
Phoenix	102	45	75.9	T.	
Pinal Ranch	.....	.....	.....	1.01	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Arizona—Cont'd.	°	°	°	*Ins.*	*Ins.*
Prescott	73	28	55.2	0.70	
San Carlos	100	40	71.3	0.35	
San Simon	98	37	71.7	0.90	
Sentinel *[1]	104	56	78.3	T.	
Signal	104	36	74.6	0.50	
Superstition	.....	.....	.....	0.28	
Taylor	88	28	58.6	0.34	3.0
Thatcher	100	36	66.4	T.	
Tombstone	90	38	69.4	1.10	
Tonto	98	42	74.3	T.	
Tuba	94	36	64.8	0.15	
Tucson	99	41	72.8	0.61	
Upper San Pedro	93	32	64.1	1.18	
Vail *[5]	92	60	75.6	0.08	
Walnutgrove	.....	.....	.....	0.02	
Wilcox	96	32	66.0	0.35	
Williams	84	25	56.4	0.92	
Yarnell	.....	.....	.....	0.11	
Young	91	31	62.4	0.65	
Arkansas.					
Alco	91	40	66.5	3.15	
Amity	88	43	66.1	3.70	
Arkadelphia	91	43	67.8	2.50	
Arkansas City	.....	.....	.....	1.56	
Batesville	90	42	67.1	2.73	
Beebranch	92[4]	41[4]	66.6[4]	4.55	
Blanchard Springs	92	43	69.2	4.19	
Brinkley	90	43	67.4	2.43	
Camden *a*	.....	.....	.....	4.68	
Camden *b*	93	52	67.8	4.05	
Conway	94	43	68.7	3.77	
Corning	89	41	66.5	1.95	
Dallas	88	43	67.7	3.19	
Dardanelle	.....	.....	.....	3.48	
De Queen	89	40	67.2	3.58	
Des Arc	91	44	68.1	2.16	
Dodd City	93	31	62.5	1.20	
Dutton	84	37	61.7	5.79	
Elon	92	44	69.2	2.64	
Eureka Springs	90	39	64.4	6.08	
Fayetteville	87	38	63.1	4.38	
Forrest City	90	43	67.5	4.47	
Fulton	.....	.....	.....	4.68	
Hardy	91	40	65.9	3.62	
Heber	92	39	66.0	2.83	
Helena *a*	.....	.....	.....	2.70	
Helena *b*	90	45	68.5	2.33	
Hope	91	46	70.6	3.83	
Howe	93	44	70.4	3.23	
Jonesboro	95	40	70.9	2.45	
Lacrosse	95	40	65.7	1.94	
Lake Village	91	46	68.9	3.17	
Lonoke	98	43	69.6	1.93	
Lutherville	90	39	63.6	3.24	
Malvern	90	40	66.8	3.00	
Mammoth Springs	90	41	63.0	3.32	
Marvell	94	43	69.1	1.48	
Mossville	85	44	63.0	4.43	
Mountain Home	92	38	65.5	2.21	
Mount Nebo	87	48	65.8	4.52	
New Gascony	.....	.....	.....	3.05	
New Lewisville	90[7]	46[7]	71.3[7]	5.65	
Newport *a*	.....	.....	.....	3.45	
Newport *b*	93	42	68.6	3.87	
Oregon	96	37	65.0	2.50	
Ozark	91	45	68.3	3.57	
Paragould	92	40	67.4	3.76	
Perry	93	45	69.0	2.52	
Pinebluff	94	44	63.6	2.15	
Pocahontas	93	42	67.0	3.79	
Pond	87	34	63.2	5.08	
Prescott	89	46	68.8	3.71	
Princeton	91	43	67.7	3.99	
Rison	91	39	65.6	4.86	
Russellville	94	42	67.6	3.29	
Silversprings	87	39	63.5	5.77	
Spielerville	93	45	68.0	5.10	
Stuttgart	91	43	67.6	2.15	
Texarkana	90	47	70.2	4.34	
Warren	95	41	69.4	2.99	
Wiggs	89	38	64.3	4.24	
Winchester	92	43	68.4	1.39	
Witts Springs	85	40	61.8	4.17	
California.					
Alturas	.....	.....	.....	0.94	T.
Angiola	105	59	71.9	0.00	
Azusa	93	38	65.2	T.	
Bagdad	100	52	79.8	T.	
Bakersfield	107	44	71.0	0.33	
Barstow	100	44	73.4	0.00	
Bear Valley	.....	.....	.....	1.09	0.7
Berkeley	85	41	60.0	0.02	
Bishop	91	37	63.4	0.06	
Boca *[1]	78	24	46.4	0.00	
Bodie	75	15	45.5	0.72	8.0
Bowman	.....	.....	.....	1.37	7.0
Branscomb	94	32	58.8	0.90	2.5
Butte Valley	.....	.....	.....	0.65	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Caliente *[1]	100	37	66.0	0.40	
Campbell	91	37	60.9	0.28	
Campo	.....	.....	.....	0.52	
Cedarville	85	27	54.6	0.61	T.
Chico	101	44	71.8	0.00	
Chino *[5]	87	47	69.1	0.00	
Cisco *[1]	70	30	48.9	0.80	8.0
Claremont	93	40	64.2	0.20	
Cloverdale	103	38	67.4	0.33	
Colusa	98	42	67.9	0.00	
Corning *[5]	105	52	6[illegible]4	T.	
Coronado	.....	.....	.....	0.12	
Craftonville	.....	.....	.....	1.12	
Crescent City	77	36	53.1	1.96	
Cuyamaca	73	26	51.4	1.15	T.
Delano *[1]	103	46	75.3	T.	
Delta	102	40	66.7	T.	
Dobbins	102	49	71.4	0.00	
Drytown	98	39	66.1	0.45	
Dunnigan *[1]	100	50	76.2	0.00	
Durham	101	36	67.8	0.04	
Elcajon	83	39	63.8	0.29	
Electra	.....	.....	.....	0.00	
Elmdale	106	40	68.0	0.05	
Elsinore	108	33	67.1	0.03	
Escondido	82	30	61.5	0.30	
Folsom	.....	.....	.....	0.28	
Fordyce	.....	.....	.....	1.55	16.0
Fort Bragg	.....	.....	.....	0.00	
Fort Ross	78	40	56.0	1.03	
Foster	.....	.....	.....	0.47	
Georgetown	92	32	62.8	0.81	T.
Gilroy (near)	93	38	61.9	0.20	
Greenville	95	29	58.0	0.89	5.0
Hanford	104	34	74.9	0.00	
Healdsburg	104	37	66.5	0.19	
Hollister	91	37	60.8	0.47	
Imperial	104	44	77.6	T.	
Indio	113	43	80.4	T.	
Iowa Hill *[1]	88	40	64.0	0.66	1.1
Irvine	.....	.....	.....	0.05	
Isabella	94[4]	42[4]	67.2[4]	0.08	
Jamestown	95	35	62.6	0.25	
Jolon	.....	.....	.....	0.00	
Kennedy Gold Mine	.....	.....	.....	0.45	
Kentfield	.....	.....	.....	0.44	
King City	99	34	63.6	0.00	
Lakeport (near)	89	40	64.6	0.00	
Laporte	81	24	53.0	0.98	9.6
Legrande	105	38	65.8	0.00	
Lemoncove	105	41	72.4	0.36	
Lick Observatory	80	27	56.6	0.45	
Livermore	98	37	64.0	0.24	
Lodi	98	44	66.0	0.29	
Los Gatos	92	40	63.4	0.19	
Lowe Observatory	.....	.....	.....	0.20	
Magnolia	91	34	63.6	0.64	
Marysville	104	41	68.6	0.00	
Merced	103	40	68.6	0.00	
Mercury	.....	.....	.....	T.	
Mills College	.....	.....	.....	0.35	
Milo	.....	.....	.....	0.23	
Milton (near)	98	41	67.3	0.01	
Modesto *[1]	103	50	70.2	0.00	
Mohave	99	45	80.2	0.00	
Mokelumne Hill	.....	.....	.....	0.08	
Montague	91	32	59.6	0.34	
Monterio	84	34	60.0	1.50	
Monterey *[1]	80	41	57.8	0.00	
Mount St. Helena	.....	.....	.....	0.05	
Napa	97	42	65.8	0.04	
Needles	105	58	83.9	0.00	
Nellie	.....	.....	.....	0.71	
Nevada City	95	32	60.6	0.29	1.0
Newcastle	101	37	70.7	0.30	
Newman	105	40	71.6	0.06	
Niles	90	42	62.9	0.32	
Nordhoff	.....	.....	.....	0.11	
North Bloomfield	95	30	61.2	0.87	
Oakland	88	45	62.8	0.36	
Ontario (near)	94	40	66.1	0.18	
Orland	106	33	70.6	T.	
Orleans	107	42	68.6	0.11	
Oroville (near)	100	40	69.9	0.00	
Palermo	102	40	68.6	0.00	
Peachland *[5]	91	45	64.2	0.30	
Pilot Creek	.....	.....	.....	1.00	6.0
Pine Crest	77	43	57.0	0.67	
Pino Grande	85	30	57.4	0.35	
Placerville	94	34	61.1	0.11	
Point Lobos	74	45	55.6	0.00	
Porterville	105	41	71.2	0.17	
Poway	.....	.....	.....	0.28	
Quincy	87	33	59.0	0.74	1.0
Redding	97	42	70.2	0.14	
Redlands	94	40	66.8	0.48	
Reedley	107	46	76.3	0.00	
Represa	92	50	67.0	0.30	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Riovista	97	42	67.0	0.02	
Riverside	95	38	64.3	0.08	
Rohnerville				0.20	
Rosewood	98	42	67.8	0.07	
Sacramento	92	44	66.4	0.13	
Salinas	91	40	59.6	0.00	
Salton	109	53	80.2	0.00	
San Bernardino	96	37	65.4	0.16	
San Jacinto				0.15	
San Jose	93	40	63.6	0.26	
San Leandro	88	40	61.2	0.23	
San Mateo*[1]	91	53	69.0	0.00	
San Miguel*[1]	95	47	66.3	0.06	
San Rafael	91	41	62.0	0.00	
Santa Barbara	78	45	59.1	0.09	
Santa Clara College	92	37	61.5	0.36	
Santa Cruz	89	36	56.8	0.02	
Santa Maria	83	37	60.2	0.10	
Santa Monica	70	45	59.8	0.00	
Santa Rosa	96	37	60.4	0.24	
Shasta	104	41	72.8	0.07	
Sierra Madre	84	45	62.0	0.07	
Sisson	92	31	57.3	0.50	
Snedden				0.00	
Sonoma				0.00	
Sonora	91	42	69.3	0.38	
Stirling City	92	27	60.4	0.92	
Stockton	93	43	66.1	0.28	
Storey	99	42	66.8	0.00	
Summerdale	80	24	55.2	0.73	3.0
Summit	70	30	50.2	0.23	2.0
Susanville	83	30	55.6	0.58	1.0
Tehama*[1]	99	56	74.3	0.10	
Tejon Ranch	98	40	69.9	0.93	
Truckee*[1]	70	26	41.9	0.45	4.5
Tulare[c]	104	40	69.9	0.11	
Tustin				0.08	
Ukiah	102	33	63.8	0.17	
Upland	88	36	61.3	0.30	
Upperlake	98	31	63.2	0.19	
Upper Mattole				0.39	
Vacaville*[1]	104	48	70.2	0.02	
Visalia	107	38	69.6	0.13	
Volcano	107	41	79.6	0.00	
Wasco	108	45	71.8	0.04	
Wheatland	100	40	67.4	0.12	
Willits	100	35	63.5	0.04	
Willow	100	41	69.4	T.	
Zenia	89	30	54.6	1.01	
Colorado.					
Alford	76	26	49.3	8.18	4.2
Antelope Springs	70	14	42.4	0.60	6.0
Ashcroft	70	20	43.0	1.60	
Blaine	90	36	61.6	2.89	
Boulder	83	32	55.4	5.35	
Breckenridge	67[f]	16	41.4[e]	4.67	41.0
Burlington	90	31	56.6	2.89	
Canyon	86	32	56.6	3.84	
Castlerock	79	28	52.8	5.94	
Cheesman	79	28	51.6	1.88	
Cheyenne Wells	88	31	57.4	2.51	
Clearview	64	6	41.3	2.40	
Collbran	83	24	54.6	1.00	
Colorado Springs	78	30	51.6	4.07	
Columbine Mine	55	7	33.4	2.39	30.0
Conejos	76	18	50.1	0.00	
Cripplecreek				6.32	23.0
Delta	97	21	58.8	0.11	
Dumont				4.42	
Durango	82	26	54.6	1.06	0.2
Fort Collins	82	28	53.7	5.37	
Fort Morgan	86	30	57.2	3.01	
Fowler				1.95	
Fox	88	30	57.6	4.60	
Fruita	89	33	59.9	1.17	
Garnett	79	14	49.0	0.16	
Gilman				2.92	12.5
Gleneyre	81	25	51.4	4.76	
Glenwood	84	26	52.9	1.24	
Greeley	86	30	56.9	3.66	
Grover				3.80	
Gunnison	78	16	47.6	0.57	1.4
Halls Gulch	55	10	32.0	5.30	35.5
Hamps	81	27	53.0	3.08	
Hoehne	89	21	55.2	0.54	
Holly	92	31	61.4	0.92	
Holyoke (near)	90	30	57.4	2.07	
Husted	76	24	49.4	5.08	T.
Lake Moraine	60	18	38.8	5.50	52.0
Lamar	95	32	63.9	1.71	
Laporte				5.32	
Las Animas	91	22	58.1	0.71	
Lay	80	10	48.2	1.78	
Leadville (near)	65	17	40.9	2.05	18.0
Leroy	84	30	55.2	3.97	
Longs Peak	65	20	40.4	5.30	29.0
Mancos	79	22	52.7	1.45	
Marshall Pass				0.50	5.0
Meeker	80	21	49.8	1.88	
Montrose	79	25	54.6	0.67	
Moraine	70	22	45.0	5.66	
Pagoda	82	24	49.7	1.03	
Parachute	84	29	56.7	1.22	
Platte Canon				4.27	
Rockyford	88	32	59.2	2.03	
Saguache	80	18	50.8	0.15	
Salida	80	24	51.3	1.28	2.0
San Luis	74	22	49.1	0.50	
Santa Clara	74[e]	21[e]	51.2[e]	2.28	
Silt	82	28	55.0	1.45	
Sugar City				2.16	
Sugar Loaf	75	23	46.4	4.42	
Telluride[d]	73	20	47.1		
Trinidad	87	33	58.6	0.75	
Victor	74	18	45.2	6.57	24.9
Vilas				2.90	
Wagon Wheel	71	16	44.8	0.14	
Walden	78	16	46.8	0.68	1.0
Wallet				2.15	
Waterdale	85	29	54.4	4.97	
Westcliffe	75	20	49.5	0.89	
Whitepine	67	13	40.7	0.89	4.0
Wray	89	30	58.8	2.02	
Yuma				4.26	
Connecticut.					
Bridgeport	87	37	61.6	2.50	
Canton	85	30	58.2	2.43	
Colchester	85	33	60.2	2.74	
Falls Village				4.49	
Hartford	84	37	61.0	3.13	
Hawleyville	85	35	59.6	4.10	
Lake Konomoc				2.37	
New London	84	46	60.8	2.22	
North Grosvenor Dale	87	33	60.4	1.88	
Norwalk	90	34	61.3	1.87	
Southington	84	33	60.5	2.63	
South Manchester				2.68	
Storrs	83	34	61.2	1.96	
Voluntown	84	31	59.4	3.30	
Wallingford				2.91	
Waterbury	86	34	61.1	3.31	
West Cornwall	83	34	59.0	4.28	
West Simsbury				2.16	
Delaware.					
Delaware City				2.62	
Milford	95	41	66.2	1.93	
Millsboro	94	41	64.8	1.33	
Newark	90	39	63.9	2.10	
Seaford	82	41	62.2	1.52	
District of Columbia.					
Distributing Reservoir*[5]	87	54	67.2	2.49	
Receiving Reservoir*[5]	85	52	67.3	2.13	
West Washington	90	41	66.2	3.20	
Florida.					
Apalachicola	90[a]	58[c]	74.3[c]	2.10	
Archer	95[1]	50[1]	75.4[1]	1.21	
Avon Park	94	58	76.1	3.82	
Bartow	95	57	77.0	1.76	
Bonifay	94	50	73.4	3.49	
Brooksville	96	52	75.6	3.12	
Carrabelle	89	50	73.8	1.99	
Clermont	97	57	78.1	1.24	
De Funiak Springs	93	47	72.4	4.29	
Deland	94	53	74.0		
Eustis	96	57	77.0	1.69	
Federal Point	96	51	73.4	1.41	
Fernandino	95	57	73.4	2.50	
Flamingo	88	61	77.0	6.47	
Fort Meade	97	55	77.0	1.03	
Fort Pierce	91	56	75.4	3.24	
Gainesville	95	53	74.9	0.88	
Grasmere	95	56	76.4		
Huntington	96	48	73.1	2.18	
Hypoluxo	91	65	76.4	3.58	
Inverness	98[b]	48[c]	75.6[c]	0.89	
Jasper	96	45	73.0	1.41	
Johnstown	94[c]	49[c]	71.2[c]	1.80	
Kissimmee	94	56	75.4	0.51	
Lake City	100	51	74.4	0.30	
Macclenny	98	49	73.2	1.34	
Madison	94	51	73.4	0.90	
Malabar	91	56	75.8	1.51	
Manatee	94	55	75.5	1.71	
Marco	94	66	78.6	1.39	
Marianna	97	44	72.4	1.84	
Merritt Island	88	63	76.5	3.80	
Miami	93	66	78.0	12.28	
Micanopy	98	52	75.4	1.75	
Middleburg	97	50	70.8	3.68	
Molino	98	44	70.8	2.63	
Monticello	95	53	73.1	4.04	
Myers	91	60	76.0	3.57	
New Smyrna	95[c]	51[c]	73.0[c]	1.89	
Nocatee	94	59	77.0	4.16	
Ocala	97	51	76.0	1.04	
Orange City	99	50	76.2	2.43	
Orange Home	98	55	76.1	1.28	
Orlando	96	56	76.4	2.16	
Pinemount	98	50	73.0	3.17	
Plant City	97	50	76.1	3.95	
Rockwell	97	52	76.0	0.84	
St. Andrews	89	50	72.0	1.32	
St. Augustine	94	53	73.8	1.57	
St. Leo	96	56	76.2	1.51	
Stephensville	94	46	72.5	1.00	
Sumner	92	47	73.0	0.47	
Switzerland	96[b]	52[b]	73.4[e]	2.39	
Tallahassee	94	56	74.6	1.05	
Tarpon Springs	100	57	78.0	0.66	
Titusville	97	54	75.2	1.07	
Wausau	95	50	73.6	2.85	
Wewahitchka	93	49	73.4	1.83	
Georgia.					
Abbeville				1.23	
Adairsville	92	45	67.2	2.53	
Albany	99	49	73.4	1.42	
Allapaha	97	50	72.8	2.12	
Americus	96	47	71.8	2.69	
Athens	92	49	68.2	1.76	
Bainbridge	95	48	74.2	3.32	
Blakely	102	48	73.7	2.05	
Bowersville	95	45	69.0	2.43	
Butler				2.74	
Carrollton	94	42	67.5	1.25	
Camak	96	47	71.2	2.24	
Canton				2.31	
Carlton				1.85	
Clayton	89	38	64.6	4.44	
Columbus	98	47	72.6	2.58	
Cordele	97	44	72.0	2.32	
Covington	94	45	69.5	2.25	
Dahlonega	90	43	64.6	3.96	
Dawson	97[b]	45[b]	71.6[e]	3.22	
Diamond	88[b]	42[c]	65.8[f]	3.60	
Douglas	97	52[m]	74.5[g]		
Dublin				1.36	
Dudley	98	45	72.2	1.62	
Eastman	97[f]	51	74.6[e]	1.13	
Eatonton	95			2.21	
Elberton	97	46	70.2	1.83	
Experiment	92	48	69.3	2.43	
Fitzgerald	102[f]	42[e]	72.8[f]	0.64	
Fleming	97	46	71.6	2.31	
Fort Gaines	96	45	72.4	1.49	
Forsyth	97	47[e]	71.0[e]	2.05	
Gainesville	93	46	67.2	2.68	
Gillsville	94	44	68.3	2.31	
Greenbush	94	43	67.4	4.19	
Greensboro	96	43	70.0	1.42	
Griffin	97	46	70.6	3.09	
Harrison	95	46	70.8	3.97	
Hawkinsville	100	43	71.4	1.45	
Jesup				1.57	
Lost Mountain	95	43	69.0	1.43	
Lumpkin	98	48	72.0	2.85	
Mauzy	98	44	73.4	1.76	
Milledgeville	95	46	70.4	2.51	
Millen	96	45	71.6	1.74	
Monticello	98	47	71.4	2.37	
Morgan	95	45	71.0	1.61	
Newnan	94	41	69.8	2.63	
Oakdale				1.46	
Point Peter	97	42	69.2	1.84	
Poulan	96	43	71.4	2.59	
Putnam	97	45	72.6	3.49	
Quitman	96	49	73.6	2.16	
Ramsey	91	39	66.2	2.55	
Resaca				1.83	
Rome	97	42	68.8	1.12	
St. Marys	98	52	73.2	2.23	
Statesboro	96	48	73.2	2.30	
Talbotton	98	43	70.6	2.81	
Tallapoosa	95	40	67.8	0.87	
Thomasville	98	47	73.4	1.39	
Toccoa	93	45	68.1	2.98	
Valona	96	47	71.8	1.99	
Washington	94	47	69.8	2.10	
Waverly	97	48	72.2	1.63	
Waycross	98	50	73.6	3.49	
Waynesboro	94	50	71.2	3.43	
Westpoint	99	44	71.5	2.48	
Woodbury	95			1.30	
Idaho.					
Albion	81[e]	27[e]	53.7[e]	1.19	
American Falls	80	23	53.8	1.28	
Blackfoot	82	22	51.1	T.	
Blue Lakes	87	31	59.5	0.76	
Burnside	70	20	48.5	0.05	T.
Cambridge	85	28	57.8	0.16	
Chesterfield	76	21	49.6	1.53	
Forney	89	22	51.7	1.75	
Garnet	90	34	63.8	0.30	
Grangeville	76	29	52.8	1.67	
Idaho City	82	23	52.4	0.26	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Idaho—Cont'd.	°	°	°	*Ins.*	*Ins.*
Lost River	76	23	51.8	0.39	T.
Lovell	69	24	47.0	0.63	
Malad City	81	28	55.0	0.87	
Meadows	79	23	49.9	0.18	
Moscow	79	32	53.5	0.73	
Murray	79	25	51.4	1.64	T.
Oakley	81	30	53.4	1.06	
Ola	81	26	55.6	0.08	
Orofino	82	29	56.0	0.85	
Paris	73	12	42.8	.....	
Payette	90	30	60.3	0.25	
Pollock	88	33	59.0	0.41	
Porthill	81	28	53.8	1.05	
Priest River	79	26	51.6	0.66	
Riddle	70	23	45.0	0.12	
Roosevelt	62	15	40.8	0.65	3.2
St. Maries	80	28	53.4	0.63	
Soldier	78	19	49.4	0.02	
Vernon	76	26	51.2	1.30	
Weston	.....	.....	.....	1.48	
Illinois.					
Albion	89	40	64.4	3.06	
Aledo	83	35	61.0	3.33	
Alexander	87	40	62.6	3.56	
Antioch	87	30	56.4	1.90	
Ashton	84	33	58.2	2.92	
Astoria	84	39	60.8	5.00	
Aurora	86	30	59.0	2.51	
Beardstown	.....	.....	.....	3.47	
Benton	92	42	67.0	3.16	
Bloomington	90	37	63.2	3.20	
Bushnell	87	40	63.8	1.35	
Cambridge	86	40	61.3	3.40	
Carlinville	87	40	63.7	2.93	
Carrollton	86	41	63.0	4.46	
Charleston	88	41	63.7	4.80	
Chester	.....	.....	.....	4.25	
Cisne	90	41	64.4	3.90	
Coatsburg	87	40	62.6	5.27	
Cobden	91	42	65.3	2.54	
Danville	89	37	63.2	1.92	
Decatur	88	38	63.2	2.67	
Dixon	87	31	59.8	3.26	
Effingham	84	38	62.5	5.25	
Equality	92	41	66.8	3.33	
Fandon	82[b]	40[b]	60.2[b]	4.27	
Flora	87	39	63.0	3.40	
Friendgrove	86	39	64.6	2.15	
Galva	86	36	60.6	3.05	
Grafton	.....	.....	.....	3.33	
Greenville	90	43	64.1	3.52	
Griggsville	88	43	64.2	5.86	
Halfway	88	44	65.4	3.18	
Havana	89	40	63.6	4.19	
Henry	85	39	61.8	3.85	
Hillsboro	89	41	63.1	4.14	
Hoopeston	.....	.....	.....	2.35	
Joliet	86	34	60.4	3.19	
Kishwaukee	86[d]	32[d]	58.8[d]	3.36	
Knoxville	84	33	60.0	3.81	
Lagrange	89	32	58.2	1.57	
Laharpe	87	40	61.7	4.60	
Lanark	92	27	59.0	3.37	
La Salle	92	28	62.6	1.99	
Loami	.....	.....	.....	3.21	
McLeansboro	89	41	65.1	3.32	
Martinsville	87[d]	39[d]	62.6[d]	3.55	
Martinton	89	32	60.8	3.92	
Mascoutah	92	39	62.4	3.25	
Mattoon	88	42	65.8	3.72	
Minonk	87	36	60.6	3.70	
Monmouth	85	34	61.6	4.61	
Morrison	85	36	59.7	3.13	
Morrisonville	88	40	62.5	2.89	
Mount Carmel	.....	.....	.....	1.32	
Mount Pulaski	87	39	62.9	2.81	
Mount Vernon	91	39	65.2	5.50	
New Burnside	91	43	66.2	3.11	
Olney	85	41	64.4	6.56	
Ottawa	87	35	61.5	3.00	
Palestine	89	41	63.8	3.16	
Pana	89	42	62.8	2.00	
Paris	86	42	63.2	3.58	
Peoria *a*	.....	.....	.....	4.06	
Peoria *b*	93	39	65.9	4.06	
Philo	85	39	61.6	3.05	
Plumhill	85	40	63.8	2.85	
Pontiac	87	37	61.5	2.67	
Rantoul	88	36	61.5	3.29	
Raum	91	43	65.1	2.70	
Riley	85	33	57.8	2.81	
Robinson	86	40	63.2	5.66	
Rockford	.....	.....	.....	3.38	
Rushville	85	41	63.0	4.63	
St. Charles	88	29	58.5	2.07	
Shobonier	86	39	63.1	4.82	
Streator	88	35	61.1	4.46	
Sullivan	88	40	62.0	4.08	
Sycamore	87	31	59.2	3.51	
Tilden	86	41	63.8	3.14	
Tiskilwa	83	38	60.0	3.29	
Tuscola	86	38	62.4	2.41	
Urbana	87	38	61.2	1.60	
Walnut	87	37	61.8	3.31	
Winchester	87	40	63.7	4.60	
Windsor	84	37	61.6	3.23	
Winnebago	86	33	58.4	3.17	
Yorkville	87	31	60.1	2.79	
Zion	87	32	58.9	3.33	
Indiana.					
Anderson	87	32	61.2	3.59	
Angola	88	32	58.6	3.84	T.
Auburn	89	30	59.0	3.10	
Bloomington	87	41	63.6	3.67	
Bluffton	88	30	59.4	3.17	
Butlerville	89	37	63.2	3.85	
Cambridge City	87	30	59.8	3.55	
Columbus	89	34	62.4	3.19	
Connersville	88	32	61.2	3.26	
Crawfordsville	85	34	61.4	3.79	
Delphi	91	30	61.2	3.10	
Elkhart	88	32	59.2	2.72	
Farmersburg	84	40	62.2	5.87	
Farmland	86	32	60.0	4.13	
Fort Wayne	89	32	60.2	3.55	T.
Franklin[e1]	90	48	64.8	3.95	
Greencastle	84	39	61.2	2.59	
Greenfield	87	34	61.8	5.06	
Greensburg	89	33	62.4	4.05	
Hammond	83	38	57.4	1.61	
Hector	89	29	61.0	3.45	
Holland	93	37	64.6	3.27	
Huntington	86	32	60.2	3.54	
Jeffersonville	91	44	66.0	2.26	
Kokomo	87	33	60.8	4.92	
Lafayette	88	34	61.4	2.98	
Laporte	89	34	60.7	2.25	
Logansport	89	31	61.8	3.49	
Madison *a*	94	39	65.6	2.99	
Madison *b*	.....	.....	.....	3.97	
Marengo	90	36	63.6	3.35	
Marion	88	29	60.5	2.85	
Markle	86	29	59.7	3.50	
Mauzy	88	30	60.6	3.29	
Moores Hill	89	34	62.7	2.82	
Mount Vernon	92	47	65.6	4.63	
Northfield	86	29	59.1	3.05	
Paoli	92	37	63.6	1.41	
Princeton	88	36	64.0	3.55	
Rensselaer	88	32	61.8	3.14	
Richmond	89	30	60.6	3.65	
Rochester	87	31	60.1	3.49	
Rockville	84	38	61.6	2.67	
Rome	95	36	66.2	2.78	
Salem	93	38	64.7	2.55	T.
Scottsburg	91	41	65.7	1.52	
Seymour	94	39	63.3	2.70	
South Bend	88	30	59.2	3.95	
Syracuse	88	29	59.6	4.09	
Terre Haute	93	44	65.0	4.41	
Topeka	84	30	57.9	[1]1.92	
Valparaiso	88	32	60.1	4.45	
Veedersburg	86[f]	35[f]	62.3[f]	2.21	
Vevay	92	41	65.0	2.77	
Vincennes	91	39	65.3	4.39	
Washington	89	41	63.2	2.43	
Winamac	89[h]	30[h]	59.4[h]	4.23	
Worthington	88	41	64.8	3.70	
Indian Territory.					
Ardmore	97	47	69.0	4.12	
Chickasha	94	43	68.4	5.42	
Claremore	99	40	68.9	4.83	
Coalgate	90	40	67.4	2.30	
Durant	93	44	68.6	3.85	
Fairland	87	41	64.7	4.43	
Goodwater	91	41	68.4	2.89	
Hartshorne	89	44	67.8	4.83	
Healdton	93	42	68.0	5.29	
Holdenville	90	41	67.2	5.47	
Marlow	92	37	67.4	4.43	
Muskogee	89	41	65.8	4.71	
Okmulgee	91	42	66.3	10.66	
Pauls Valley	92	40	67.9	5.92	
Ravia	91	45	69.0	3.83	
Roff	90	43	67.4	6.14	
South McAlester	90	45	68.8	4.36	
Tahlequah	84	40	63.7	5.49	
Tulsa	.....	.....	.....	4.55	
Vinita	92	38	65.7	4.07	
Wagoner	91	40	66.6	5.70	
Webbers Falls	91	43	66.3	6.19	
Iowa.					
Afton	87	36	61.2	4.20	
Albia	84	33	59.1	2.61	
Algona	88	33	58.7	3.06	
Allerton	84	37	60.0	3.51	
Alta	85	34	58.1	6.39	
Amana	86	36	60.2	3.88	
Ames	85	35	60.0	3.69	
Atlantic	87	32	59.7	4.20	
Audubon	88	31	59.2	3.42	
Baxter	85	35	59.8	3.37	
Bedford	84	35	59.6	4.50	
Belknap	83	40	61.9	3.59	
Belleplaine	87	37	58.4	3.41	
Bonaparte	84	37	60.6	4.17	
Britt	87	30	57.6	3.62	
Buckingham	.....	.....	.....	2.74	
Burlington	83	41	62.4	3.70	
Carroll	86	31	58.7	3.27	
Cedar Rapids	89	35	60.9	3.36	
Chariton	83	36	59.1	2.80	
Charles City	88	27	57.6	3.58	
Clarinda	90	36	59.6	4.11	
Clearlake	85	35	60.8	1.50	
Clinton	90	33	61.0	2.50	
College Springs	85[c]	35[b]	62.0[c]	3.00	
Columbus Junction	85	35	60.6	3.16	
Corning	83	36	59.2	5.55	
Corydon	84	35	60.3	3.06	
Cresco	90	32	59.6	5.35	
Cumberland	.....	.....	.....	3.42	
Decorah	86	32	59.1	5.19	
Delaware	86	32	58.6	3.42	
Denison	86	34	59.4	3.41	
Desoto	86	37	60.8	3.09	
Dows	86	32	57.8	4.60	
Earlham	84	31	56.8	2.78	
Elkader	90	30	60.2	3.50	
Estherville	82	32	56.8	3.57	
Florence	.....	.....	.....	4.68	
Forest City	89	32	58.2	2.44	
Fort Dodge	86	35	59.0	5.16	T.
Fort Madison	.....	.....	.....	3.58	
Galva	88	32	58.3	7.81	
Gilman	.....	.....	.....	2.05	
Gladbrook	86	35	61.0	5.35	
Grand Meadow	86	32	58.0	6.51	
Greene	88	30	59.2	4.70	
Greenfield	86	33	60.0	4.16	
Grinnell	84	37	59.8	2.61	
Grundy Center	88	34	58.9	3.55	
Guthrie Center	88	33	60.7	3.20	
Hampton	88	34	59.6	4.55	
Hanlontown	88	29	56.8	2.95	
Harlan	87	34	59.9	3.07	
Hopeville	84	37	59.8	5.04	
Humboldt	88	34	59.6	3.60	
Ida Grove	86	34	60.9	5.42	
Independence	85	30	57.8	2.45	
Indianola	85	37	60.6	3.08	
Inwood	81	33	57.4	2.27	
Iowa City	88	36	61.0	2.68	
Iowa Falls	87	30	57.5	5.29	
Jefferson	.....	.....	.....	2.76	
Keosauqua	87	35	61.2	4.39	
Lacona	.....	.....	.....	4.32	
Larrabee	90	32	58.9	4.74	
Leclaire	.....	.....	.....	2.71	
Lemars	87	33	58.7	3.25	
Lenox	83	35	59.5	4.28	
Leon	83	37	61.0	4.47	
Logan	90	32	60.8	3.02	
Maple Valley	.....	.....	.....	6.34	
Maquoketa	86	32	58.8	2.42	
Marshalltown	90	34	59.6	3.45	
Mason City	88	35	59.3	3.55	
Montezuma	.....	.....	.....	2.32	
Monticello	88	34	59.0	2.90	
Mountayr	88	36	61.2	6.51	
Mount Pleasant	88	40	61.8	4.37	
Mount Vernon	91	35	61.1	2.93	
New Hampton	85[d]	31[e]	57.0[e]	3.31	
Northwood	85	34	57.6	3.11	
Odebolt	89	32	60.4	3.41	
Ogden	85	30	59.2	2.63	
Olin	85	33	59.4	2.46	
Onawa	88	35	62.4	8.15	
Osage	87	31	58.0	3.03	
Osceola	87	31	59.9	5.66	
Oskaloosa	84	36	60.2	1.96	
Ottumwa	87	38	62.0	3.09	
Pacific Junction	88	32	60.9	4.68	
Perry	89	36	61.1	2.28	
Plover	90	33	59.1	4.74	
Pocahontas	89	34	59.7	4.61	
Primghar	86	31	57.3	3.60	
Redoak	84	40	61.3	3.68	
Ridgeway	93	35	62.4	4.39	
Rock Rapids	92	34	60.2	2.20	
Rockwell City	88	33	59.8	3.70	
Ruthven	89	35	57.6	3.50	
Sac City	86	34	59.8	4.06	
St. Charles	85	37	60.4	3.80	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Iowa—Cont'd.	°	°	°	*Ins.*	*Ins.*
Sibley	86	33	56.4	2.97	
Sigourney	86	36	61.6	3.09	
Sioux Center	86	32	58.4	2.21	
Stockport	92	38	61.8	4.32	
Storm Lake	84	34	57.0	3.74	
Stuart	88	36	60.4	2.56	
Thurman	89	35	61.8	4.14	
Tipton	88d	38	61.4	2.37	
Toledo	86	34	59.7	2.88	
Villisca	85	35	60.0	5.02	
Vinton	87	33	60.4	2.39	
Wapello	82	40	61.6	2.61	
Washington	85	39	60.5	3.01	
Washta				6.08	
Waterloo	89	33	58.8	4.62	
Waukee	90	35	62.0	3.46	
Waverly	87	32	59.6	4.69	
Westbend	86	33	58.8	3.55	
West Union				4.51	
Whitten	89	34	59.8	3.49	
Wilton Junction	87	33	61.1	2.79	
Winterset	90	38	60.7	2.32	
Woodburn				4.55	
Zearing	85	34	59.0	3.09	
Kansas.					
Achilles	94	28	59.5	2.21	
Alton	92	32	62.0	5.41	
Anthony				8.28	
Atchison	89	38	62.2	8.16	
Baker	86	36	61.0	7.68	
Beloit	89	35	61.0	5.11	
Burlington	88	36	63.0	6.99	
Chapman	83	37	62.1	6.86	
Clay Center	87	32	62.0	6.45	
Coffeyville	92	40	66.6	.....	
Colby	93	28	59.4	2.42	
Columbus	86	39	64.0	3.78	
Cunningham	86	35	62.4	7.02	
Dresden	93	34	60.4	3.53	
Eldorado	86	36	62.6	5.28	
Ellinwood	87	36	63.0	4.66	
Ellsworth	92	32	63.6	5.34	
Emporia	82	37	62.4	8.32	
Englewood	94	36	66.7	3.73	
Enterprise	84	35	52.2	6.39	
Eureka				7.72	
Fall River	85	37	62.2	6.83	
Farnsworth	91	29	61.4	4.59	
Forsha	81	34	62.2	5.62	
Fort Leavenworth	86	41	63.4	9.39	
Fort Scott	90	39	63.7	6.23	
Frankfort	89	33	60.8	5.84	
Fredonia	87	39	63.8	4.21	
Garden City	94	37	63.5	4.30	
Gove*1	93	34	57.8	4.13	
Grenola	84	36	61.6	7.52	
Harrison	89	31	61.0	2.60	
Hays	92	31	59.2	0.89	
Holton	88	39	61.9	5.99	
Horton	87	38	61.2	8.46	
Hoxie	92	31	61.0	2.98	
Hugoton	92	34	65.8	1.80	
Hutchinson	85	33	61.7	5.26	
Independence	92	41	65.6	4.26	
Jetmore	88	35	62.4	3.91	
La Crosse	91	32	61.8	2.28	
Lakin	91	32	62.3	2.81	
Larned	90	29	60.7	3.14	
Lebanon	89	32	60.8	3.70	
Lebo	85	38	62.6	10.21	
Macksville	88	33	61.5	4.64	
McPherson	86	37	63.4	5.19	
Madison	86	38	61.8	7.72	
Manhattan *b*	87	34	63.3	5.67	
Manhattan *c*	88	36	63.0	6.21	
Marion	89	36	63.4	8.15	
Medicine Lodge	94	39	67.4	7.67	
Minneapolis	86	34	61.8	6.74	
Moran	88	38	63.3	6.92	
Mounthope	83	42	62.4	4.93	
Ness City	88m	31m	59.2m	2.51	
Newton	84	35	62.6	6.69	
Norton	94	28	61.1	3.41	T.
Norwich	87	39	63.0	8.14	
Oberlin				4.49	
Olathe	84	39	63.8	11.71	
Osage City	84	39	61.7	10.02	
Osborne				5.26	
Oswego	89	38	64.2	3.28	
Ottawa	86	35	62.0	11.68	
Paola	86	41	63.5	9.92	
Pleasanton	87	41	64.0	5.28	
Republic	88	32	61.7	6.51	
Salina	85	32	61.6	6.88	
Sedan	91	41	64.6	5.14	
Toronto	91	35	62.9	6.61	
Ulysses	91	35	62.8	3.34	
Valley Falls	86	38	61.5	6.30	
Kansas—Cont'd.					
Viroqua	94	35	63.8	2.40	
Wakeeney				5.12	
Wallace	92	31	60.3	1.28	
Walnut	86	40	63.2	4.36	
Wamego*1	84	44	62.5	7.44	
Winfield	88	36	63.4	6.47	
Yates Center	90	36	62.6	6.82	
Kentucky.					
Alpha	92	42	66.0	4.78	
Anchorage	93	37	64.4	1.88	
Bardstown	94	36	66.2	2.25	
Beattyville	94	36	63.6	4.34	
Beaver Dam	93	35	65.2	2.11	
Berea	91	38	65.0	5.10	
Blandville	88	40	65.5	2.00	
Bowling Green	94	36	65.8	2.32	
Burnside	90	38	64.6	4.30	
Cadiz	94	38	66.2	2.72	
Calhoun	93	37	66.6	2.70	
Catlettsburg	91	41	65.0	3.64	
Earlington	91	37	65.3	5.73	
Edmonton	91	35	64.0	4.17	
Eubank	89	33	62.8	2.51	
Falmouth				1.92	
Fords Ferry	91	34	65.2	1.68	
Frankfort	89	40	64.2	2.27	
Franklin	92	46	67.7	2.20	
Greensburg	93	34	64.2	2.50	
Highbridge	90	39	64.3	3.34	
Hopkinsville	91	35	64.8	2.98	
Irvington	92	40	66.0	2.07	
Jackson	90	40	63.7	4.11	
Leitchfield	90	37	64.6	1.37	
Loretto	89	36	63.6	2.92	
Mayfield	86d	40e	65.7e	2.86	
Maysville	96	37	64.4	2.47	
Middlesboro	89f	37f	64.0f	4.84	
Mount Sterling	91	40	64.2	5.69	
Owensboro	90	40	66.1	2.23	
Owenton	93	.....	.....	2.01	
Paducah *a*				1.66	
Paducah *b*	95	43	68.4	1.21	
Princeton	94	37	66.0	2.87	
Richmond	91	38	65.0	4.56	
St. John	89	36	64.0	3.50	
Scott	90	36	63.4	4.10	
Shelby City	98	35	63.4	6.24	
Shelbyville	95	40	65.6	1.23	
Taylorsville	90	38	64.3	2.15	
Williamsburg	90	33	63.7	2.90	
Williamstown	90	39	63.0	1.37	
Louisiana.					
Abbeville	95	52	74.5	1.66	
Alexandria	94	46	72.2	3.41	
Amite	92	46	71.4	2.79	
Baton Rouge	93	52	73.0	3.28	
Burnside	92	49	71.4	2.79	
Calhoun	93	45	69.9	5.15	
Cameron	89	57	73.4	2.96	
Caspiana	94	47	71.8	3.55	
Cheneyville	96	46	71.4	3.30	
Clinton	91	47	71.0	3.90	
Collinston	93	46	72.0	2.69	
Covington	93	49	73.0	4.65	
Donaldsonville	95	50	73.2	2.78	
Emilie	93	53	72.2	3.81	
Farmerville	89	49	71.6	4.23	
Franklin	96	51	74.0	2.50	
Grand Coteau	93	51	72.6	4.69	
Hammond	93	46	71.6	1.79	
Houma	93	47	72.2	1.01	
Lafayette*	92	50	72.4	4.23	
Lakeside	93	58	73.9	2.29	
Lawrence	93	49	73.4	2.37	
Leesville	92	44	70.8	4.23	
Libertyhill	94	43	69.7	5.43	
Logansport				2.25	
Mansfield	92	43	69.4	2.41	
Melville	93	47	71.5	1.36	
Minden	93	48	70.3	4.84	
Monroe	96	51	73.6	3.26	
New Iberia	90	55	72.9	2.41	
Opelousas	94	48	71.7	3.59	
Oxford	95	44	71.2	2.29	
Plain Dealing	92	43	69.8	4.19	
Port Eads	87	60	73.0	3.46	
Rayne	95	52	73.0	5.80	
Reserve	97	53	73.8	2.95	
Robeline	93	43	69.6	1.56	
Ruston	92	44	70.4	6.55	
St. Francisville	95	45	71.8	1.43	
Schriever	98	47	72.4	2.90	
Southern University				4.05	
Sugar Experiment Station	91	55	73.0	3.21	
Sugartown	93	50	72.1	2.71	
Venice	89	50	70.6	3.27	
Maine.					
Bar Harbor	80	29	54.6	4.62	
Maine—Cont'd.					
Belfast	81	32	56.4	6.51	
Chesuncook				3.49	
Cornish	84	36	59.8	5.71	
Danforth				4.31	
Fairfield	81	31	58.2	4.75	
Farmington	84	30	58.1	5.72	
Fort Fairfield	85e	20e	52.8e	2.10	
Gardiner	82	31	58.0	3.95	
Grant Farm				4.01	
Houlton	82	28	55.9	3.65	
Lewiston	84	35	59.2	4.34	
Madison	80	32	57.8	6.63	
Mayfield	78	34	56.6	6.86	
Millinocket	86	28	59.6	4.38	
North Bridgton	83	32	59.4	4.31	
Oquossoc	81	25	55.0	3.23	
Orono	82	29	58.2	4.26	
Patten	84	25	54.8	4.25	
Rumford Falls	80	34	58.4	3.89	
South Lagrange	83	30	58.2	4.85	
The Forks				5.08	
Thomaston	80	31	54.9	7.00	
Vanburen	83	25	53.8	5.04	
Vanceboro	84	24	54.8	2.92	
Winslow	84	30	57.4	4.91	
Maryland.					
Annapolis	80	43	66.3	2.95	
Bachmans Valley	90	34	61.6	3.44	
Boettcherville	102	33	65.2	4.27	
Cambridge	94	44	66.5	2.74	
Charlotte Hall	91e	41e	65.0e	1.52	
Chase	85	39	62.7	2.21	
Cheltenham	90	41	64.4	2.56	
Chestertown	87	44	64.4	3.02	
Chewsville	88	34	61.4	2.68	
Clearspring	88	34	62.0	4.29	
Coleman	90	43	65.2	3.06	
Collegepark				1.79	
Colora				2.06	
Cumberland				1.33	
Darlington	89	40	64.2	1.95	
Deerpark				3.83	
Denton	92g	.....	65.3g	2.62	
Easton	87	42	64.4	2.23	
Fallston	87	41	63.0	2.17	
Frederick	92	36	64.2	3.76	
Grantsville	86	31	58.0	2.89	T.
Greatfalls	93	35	64.4	1.61	
Greenspring Furnace	92	36	62.8	2.88	
Hancock	95	34	64.3	3.39	
Harney				2.58	
Jewell	88	44	64.8	1.88	
Johns Hopkins Hospital	89	45	67.0	2.18	
Laurel	94	38	65.7	2.05	
Mount St. Marys College	88	40	63.5	3.05	
New Market	90	39	64.0	3.10	
Oakland	87	26	56.6	4.00	T.
Pocomoke City	89	43	65.7	1.95	
Prince Fredericktown	90	41	64.7	1.93	
Princess Anne	87	40	63.4	1.56	
Solomons	87	47	65.1	2.07	
Sudlersville	91	40	66.4	2.25	
Takoma Park	91	41	64.1	2.65	
Van Bibber	87	41	63.7	2.25	
Westernport	93	34	62.1	2.91	
Woodstock	91	42	65.2	3.09	
Massachusetts.					
Amherst	85	37	60.3	4.55	
Bedford	83	36	59.2	3.77	
Bluehill (summit)	84	41	59.3	2.96	
Cambridge	87	36	61.6	3.77	
Chestnuthill	89	34	61.6	3.28	
Concord	86	34	60.0	3.72	
East Templeton*1	87	43	61.9	3.02	
Fall River	80	42	60.2	2.84	
Fitchburg *a*1	86	45	60.1	3.28	
Fitchburg *b*	86	37	60.6	3.53	
Framingham	89	34	60.8	2.44	
Groton	86	35	59.2	4.80	
Hyannis				4.29	
Jefferson				3.43	
Lawrence	89	36	60.4	2.55	
Leominster				3.43	
Lowell *a*	87	37	62.4	2.98	
Lowell *b*	88	40	62.0	.....	
Ludlow Center	80	29	55.8	2.69	
Middleboro	83	29	59.3	2.56	
Monson	85	38	59.4	2.34	
New Bedford	75	37	57.6	3.55	
Plymouth*1				2.27	
Princeton				2.93	
Provincetown	78	36	58.8	2.50	
Salem				4.25	
Somerset*1	89	36	62.8	2.75	
Sterling				3.02	
Taunton	82	31	59.0	2.50	
Webster				2.33	
Westboro	91	33	62.2	1.99	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Massachusetts—Cont'd.	°	°	°	*Ins.*	*Ins.*
Weston	86	34	59.7	3.36	
Williamstown	83	35	59.6	3.24	
Winchendon	.....	.....	.....	3.16	
Worcester	89	40	62.0	2.06	
Michigan.					
Adrian	89	29	59.4	2.20	
Agricultural College	85	31	57.4	2.40	
Allegan	89[c]	28[c]	57.6[c]	1.34	
Alma	84	29	57.5	3.37	
Ann Arbor	88	32	58.4	2.31	
Annpere	80[c]	30[j]	58.2[b]	.....	
Arbela	84	36[c]	58.2[d]	3.41	
Baldwin	85	30	58.6	5.00	
Ball Mountain	88	30	57.2	1.74	
Baraga	85	.....	.....	.....	
Battlecreek	87	30	57.6	2.60	
Bay City	85	29	56.6	1.95	
Benzonia	77[d]	26[d]	54.4[d]	3.91	
Berlin	87	31	57.0	2.52	
Berrien Springs	89	34	59.4	2.41	
Big Rapids	81	26	56.0	3.34	T.
Birmingham	89	32	58.4	1.85	
Bloomingdale	90	27	58.1	1.90	
Calumet	77	29	50.6	2.22	3.0
Carsonville	85[f]	30[j]	56.7[b]	.....	
Cassopolis	87	30	59.9	2.70	
Charlevoix	78	27	51.8	5.42	T.
Charlotte	86	30	59.2	3.38	
Chatham	80	22	48.5	6.34	T.
Cheboygan	80	25	52.4	4.94	T.
Clinton	88	30	58.5	2.78	
Coldwater	88	29	60.0	2.95	
Deer Park	80	24	45.9	8.44	4.5
Detour	72	30	48.2	5.56	T.
Dundee	90	32	59.0	3.06	
Eagle Harbor	74[b]	20[d]	45.6[d]	3.62	T.
East Tawas	78[c]	28[c]	53.0[c]	3.78	
Eloise	90	35	59.6	1.19	
Ewen	81	19	50.0	.....	
Fitchburg	86	28	57.4	4.54	T.
Flint	84	30	56.8	2.57	
Gaylord	79	19	50.4	4.20	1.0
Gladwin	84	23	56.1	3.60	
Grand Haven	77	34	55.2	4.20	
Grand Marais	75[a]	28[c]	46.4[c]	4.87	2.0
Grape	90	32	58.6	2.71	
Grayling	82[m]	25[m]	57.4[m]	.....	
Hagar	87	28	56.6	3.24	
Harbor Beach	84	26	53.6	2.17	
Harrison	81	23	57.0	4.25	
Harrisville	80	28	52.0	4.43	
Hastings	87	28	59.0	3.67	
Hayes	85	34	56.2	4.50	
Highland	.....	.....	.....	3.03	
Hillsdale	87	29	57.4	3.16	
Humboldt	75	29	47.7	.....	T.
Ionia	85[c]	28[c]	56.8[c]	.....	
Iron Mountain	80	25	53.2	5.17	T.
Iron River	83	23	52.0	4.20	T.
Ishpeming	74[c]	27[b]	46.4[c]	4.88	1.0
Ivan	74	27	49.4	4.07	T.
Jackson	89	32	60.2	3.47	
Jeddo	86	33	57.2	2.01	
Kalamazoo	84[c]	30[b]	58.6[d]	2.66	
Lake City	.....	34	.....	1.70	
Lansing	86	30	57.6	3.60	
Lapeer	89	30	58.2	2.70	
Mackinac Island	77[c]	28[c]	50.2[c]	10.35	0.2
Mackinaw City	76	29	48.2	8.65	T
Manceiona	80	12	53.1	.....	
Manistee	78	30	53.5	.....	
Marine City	89	30	57.5	1.97	
Menominee	83	31	51.7	6.28	
Midland	85	35	59.8	1.49	
Mio	80	23	54.0	3.55	T.
Montague	73	30	53.2	2.28	T.
Mount Clemens	.....	.....	.....	4.50	
Mount Pleasant	.....	.....	.....	2.80	
Muskegon	79	33	56.8	6.20	
Newberry	80	21	48.8	.....	
Old Mission	80	27	52.0	3.81	
Olivet	84	32	58.2	4.15	
Omer	81	19	54.8	1.60	
Onaway	81	26	53.4	4.70	T.
Ovid	84	29	57.6	3.19	
Owosso	84[c]	29[d]	58.9[c]	.....	
Petoskey	78	32	52.6	11.09	T.
Plymouth	90	30	59.2	.....	
Port Austin	85[c]	35[c]	57.9[c]	3.70	
Reed City	80	31	56.8	3.43	T.
Roscommon	80[b]	28[b]	57.0[b]	2.00	T.
Saginaw (W. S.)	86	28	58.3	3.97	T.
St. Ignace	75	13	49.3	3.42	
Slocum	77	31	55.2	2.95	
South Haven	80	28	54.1	1.05	
Thomaston	82	20	50.7	.....	
Thornville	85	38	58.5	2.20	
Traverse City	78	27	48.7	3.63	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Michigan—Cont'd.	°	°	°	*Ins.*	*Ins.*
Vassar	85	30	57.6	2.11	
Wasepi	88	31	58.0	2.97	
Webberville	86	29	57.2	2.78	
West Branch	81	25	54.7	1.77	
Wetmore	82[d]	26[b]	49.0[b]	0.33	
Whitefish Point	.....	24	.....	7.37	.....
Ypsilanti	87	31	58.8	2.58	
Minnesota.					
Albert Lea	86	.....	.....	3.15	
Alexandria	84	30	54.6	3.33	
Angus	83	26	53.9	1.74	
Ashby	84[d]	31[d]	54.1[d]	3.35	
Beardsley	86	32	55.8	2.32	
Beaulieu	81	28	54.8	2.26	
Bemidji	80	29	54.2	2.44	
Bird Island	86	33	57.0	1.01	
Blooming Prairie	85	28	56.2	1.19	
Brainerd	83	26	54.2	0.95	
Caledonia	84	36	61.3	3.70	
Campbell	85	29	55.0	2.76	
Collegeville	83	32	56.0	2.82	
Crookston	83	33	54.6	2.09	
Currie	85[d]	30[c]	55.2[b]	.....	
Deephaven	.....	.....	.....	3.35	
Detroit City	82	27	52.8	2.99	
Faribault	84	28	55.6	2.89	
Farmington	83	32	56.9	2.55	
Fergus Falls	80	33	55.8	2.82	
Glencoe	85	.....	.....	1.67	
Grand Meadow	87	31	56.6	3.98	
Hallock	85	23	54.4	1.95	
Lake Winnibigoshish	80	27	51.5	1.34	
Leech	81	24	51.6	0.76	
Long Prairie	84	26	54.8	2.39	
Luverne	85	24	54.5	2.89	
Lynd	86	32	55.5	1.63	
Mapleplain	86	32	57.4	3.31	
Milaca	85	25	53.4	2.90	
Milan	90	30	56.6	1.72	
Minneapolis [1]	85*	31	56.8	3.44	
Montevideo	90	33	57.6	1.77	
Morris	84	30	56.0	3.49	
Mount Iron	84	25	51.1	1.35	1.0
New London	86	34	57.0	4.63	
New Richland	88	33	58.2	1.67	
New Ulm	87	33	58.6	1.68	
Park Rapids	80	29	51.8	1.70	
Pine River	82	27	53.6	1.93	
Pipestone	81	32	55.6	3.62	
Pleasant Mounds	84	33	57.9	2.63	
Pokegama Falls	83	19	50.0	1.06	
Redwing *a*	.....	.....	.....	3.29	
Reeds	.....	.....	.....	2.00	
Rolling Green	83	35	58.1	2.50	
St. Charles	82	20	57.4	5.44	
St. Cloud	85	32	58.8	2.95	
St. Peter	87	31	58.7	1.74	
Sandy Lake Dam	83	26	52.0	0.90	
Shakopee	86	33	58.0	1.86	
Tower	77	27	45.2	1.95	1.5
Two Harbors	80	25	48.3	2.33	T.
Wabasha	87	30	60.0	2.42	
Wadena	83	31	54.5	1.75	
Willow River	87	24	52.4	1.67	
Winnebago	88[c]	34	58.6[b]	1.69	
Winona	84	33	59.0	4.40	
Worthington	84	33	56.8	2.89	
Wyoming	.....	.....	.....	4.22	
Zumbrota	85	29	57.4	2.62	
Mississippi.					
Aberdeen	98	43	70.0	2.98	
Agricultural College	93	49	71.4	3.22	
Austin	90	42	69.3	2.27	
Batesville	94	42	68.6	2.48	
Bay St. Louis	90	51	72.2	3.02	
Biloxi	90	54	73.4	2.16	
Booneville	93	45	69.1	2.87	
Brookhaven	95	43	70.8	1.75	
Canton	93	44	70.2	3.31	
Columbia	94	.....	.....	1.60	
Columbus	91	46	67.8	3.08	
Corinth	90	43	66.2	4.09	
Crystal Springs	92	48	70.9	3.95	
Duck Hill	96	40	69.0	1.06	
Edwards	92	44	69.8	1.83	
Fayette	90	43	69.6	3.15	
Fayette (near)	.....	.....	.....	2.51	
Greenville *a*	89	52	70.6	1.17	
Greenville *b*	93	48	71.1	1.33	
Greenwood	97	45	70.0	3.13	
Hattiesburg	93	43	71.0	4.43	
Hazlehurst	91	47	70.0	4.90	
Hernando	90	45	69.1	2.23	
Holly Springs	93	48	69.2	3.47	
Indianola	95	44	70.2	2.27	
Jackson	93	44	69.6	3.45	
Kosciusko	94	44	70.0	2.56	
Lake	93	41	68.9	3.17	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Mississippi—Cont'd.	°	°	°	*Ins.*	*Ins.*
Lake Como	93	41	68.6	5.53	
Leakesville	94	41	70.6	5.59	
Louisville	94	44	69.6	1.10	
McNeill	95	52	72.3	2.57	
Macon	95	45	68.0	2.92	
Magee	92	43	69.3	5.17	
Magnolia	96	46	72.0	5.05	
Natchez	93	49	73.0	1.10	
Nitta Yuma	93	47	71.4	2.20	
Okolona	101	40	71.1	1.75	
Patmos	.....	.....	.....	2.21	
Pearlington	92	49	71.7	1.81	
Pittsboro	97	41	69.7	1.29	
Pontotoc	90	43	68.0	0.42	
Poplarville	92	51	72.2	3.73	
Port Gibson	93	41	69.8	3.21	
Ripley	90	40	65.7	5.05	
Shelby	.....	.....	.....	1.90	
Shoccoe	94	42	69.5	4.09	
Stonington	.....	.....	.....	3.20	
Suffolk	97	44	71.2	1.90	
Swartwout	90[d]	46	71.0	3.44	
Tupelo	94[c]	40[f]	67.0[c]	2.43	
University	92	41[j]	69.8[f]	3.16	
Utica	93	42	70.8	1.38	
Watervalley	94	43	68.6	2.44	
Waynesboro	92	44	70.8	3.15	
Woodville	94	48	73.1	2.52	
Yazoo City	94	45	70.6	2.65	
Missouri.					
Appleton City	88	37	63.4	7.85	
Arthur	86	39	63.2	8.75	
Avalon	88	38	62.2	5.53	
Bagnell	.....	.....	.....	5.59	
Bethany	85	37	60.3	3.49	
Birchtree	87	42	64.8	2.58	
Blue Springs	83	39	61.8	8.71	
Boonville	.....	.....	.....	8.21	
Brunswick	86	42	62.4	6.95	
Caruthersville	89	42	66.6	4.23	
Darksville	84	40	62.0	5.60	
Dean	90	34	61.6	2.93	
Desoto	91	40	64.8	2.73	
Donephan	99	38	65.7	1.45	
Downing	.....	.....	.....	4.95	
Fairport	.....	.....	.....	4.09	
Fayette	83	39	60.4	5.46	
Fulton	88	38	63.6	4.96	
Gallatin *e j*	86	40	63.6	6.33	
Gano	89	40	64.3	3.62	
Glasgow	84	44	63.0	6.14	
Gorin	.....	.....	.....	3.05	
Grant City	84	36	60.8	4.74	
Halfway	84	40	63.2	3.02	
Harrisonville	87	39	62.8	10.45	
Hazlehurst	.....	.....	.....	5.00	
Hermann	.....	.....	.....	4.39	
Houston	87	34	63.0	2.47	
Huntsville	86	41	63.2	6.45	
Ironton	90	32	63.4	1.59	
Jackson	95	36	65.5	5.03	
Jefferson City	88	42	65.5	4.56	
Joplin	88	41	64.8	3.52	
Kidder	85	38	61.2	6.76	
Koshkonong	88	41	64.6	2.90	
Lamar	88	40	64.6	4.53	
Lamonte	.....	.....	.....	8.66	
Lebanon	87	41	64.2	3.72	
Lexington	86	42	63.1	9.56	
Liberty	85	40	62.8	10.44	
Lockwood	.....	.....	.....	2.60	
Louisiana	88	39	63.2	4.91	
Macon	87	40	63.3	6.09	
Marblehill	91	36	64.4	1.85	
Marshall	85	40	62.2	8.11	
Maryville	90	36	60.8	4.48	
Mexico	89	41	62.8	5.95	
Miami *e b*	87	48	64.2	9.05	
Monroe City	87	40	63.1	5.41	
Montreal	88	35	62.2	6.25	
Mountaingrove	85	39	62.8	2.47	
Mount Vernon	90	36	62.6	3.25	
Neosho	88	36	63.4	3.30	
Nevada	.....	.....	.....	7.54	
New Haven	89	43	64.6	4.67	
New Madrid	.....	.....	.....	3.56	
New Palestine	85	44	63.7	6.64	
Oakfield	89	42	64.2	5.32	
Olden	90	35	64.9	3.90	
Oregon	88	37	62.0	4.81	
Pine Hill	.....	.....	.....	1.78	
Princeton	90	38	62.1	5.11	
Protem	91[d]	39[d]	64.8[d]	2.57	
Rockport	.....	.....	.....	4.44	
Rolla	.....	.....	.....	6.32	
St. Charles	88	46	65.0	3.92	
St. Joseph	.....	.....	.....	6.32	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Missouri—Cont'd.	°	°	°	*Ins.*	*Ins.*
Sarcoxie				3.66	
Sedalia	86	40	63.8	5.97	
Seymour	85	33	61.4	3.67	
Sikeston	90	44	65.4	4.80	
Steffenville	85	42	62.0	3.93	
Sublett	84	38	61.6	5.91	
Trenton	84	40	62.2	4.42	
Unionville	84	38	60.6	4.16	
Vichy	89	37	64.8	5.47	
Warrensburg	86	40	63.6	8.80	
Warrenton	89	43	64.0	4.08	
Warsaw	88	34	62.1	5.52	
Wheatland				5.33	
Willowssprings	86	34	62.4	2.12	
Zeitonia	90	36	64.0	3.18	
Montana.					
Adel	74[1]		47.8[1]		
Anaconda	78	23	48.4		
Augusta	77	20	49.5	0.92	6.0
Boulder	73	23	48.4	1.11	T.
Bozeman	74	28	48.2	2.02	4.4
Butte	72	28	49.0	1.02	
Canyon Ferry	82	28	52.7	0.65	T.
Cascade	84	26	54.0	1.52	T.
Chester	83	23	51.4	0.16	0.5
Chinook	86[e]	26[e]	54.6[e]	2.11	
Columbia Falls	81	22	50.2	1.57	T.
Crow Agency	86	25	55.8	1.00	T.
Culbertson	82	27	53.2	1.40	
Cutbank				0.96	
Dayton	80	27	53.4		
Deerlodge	76	25	48.8		
Dillon	78	25	52.0	2.54	T.
Fort Benton	86	28	51.8	1.96	
Fort Harrison	86	34	56.3		
Glasgow	83	21	54.6	0.70	
Glendive	80	29	53.2	0.80	T.
Greatfalls	82	30	54.2	1.16	
Hamilton	81	28	53.7	1.31	1.0
Lewistown	79	24	49.6	2.10	9.0
Livingston	79	23	53.0	1.90	T.
Lodge Grass	95	26	58.8	2.56	
Marysville	70[e]	25[e]	45.9[e]	1.71	14.0
Missoula	84	30	54.0	1.20	
Ovando	75	23	48.0	1.06	T.
Parrot	79	28	51.7	0.88	
Philipsburg	89	20	49.5	1.10	T.
Plains	78	28	53.6	0.30	
Poplar	85	31	55.4	0.55	
Redlodge	75	23	47.2	4.20	4.0
Ridgelawn	85	27	54.6	0.57	
St. Pauls	82	19	48.4	2.16	
St. Peter	77	18	48.9	2.29	18.0
Springbrook	83	27	53.6	1.43	T.
Toston	84	24	53.2	1.40	
Townsend				1.88	
Troy	82	25	52.2	1.45	
Twin Bridges	80	24	50.6	0.30	
Two Dot	82	27	54.0	1.72	13.5
Utica	82	24	49.0	1.94	
Wolf Creek	78	26	49.8	1.42	4.5
Wolsey	71	18	44.1	2.29	6.5
Yale	79	19	49.5	0.91	4.0
Nebraska.					
Agate	80	21	53.4	2.56	T.
Agee[*1]	92	33	57.5	2.73	
Albion	91	27	58.3	5.63	
Alliance	83	26	56.2	2.36	
Alma	96	29	62.8	4.39	
Ansley	91	25	58.8	5.83	
Arapahoe				2.68	
Arcadia				5.86	
Ashland *a*	89	34	61.9	5.96	
Ashland *b*				7.44	
Ashton				4.60	
Auburn	89	37	59.8	3.99	
Aurora	91	38	63.2	1.55	
Bartley	100	28	62.0	2.74	
Beatrice	87	34	61.9	4.52	
Beaver	95	32	61.9	3.53	
Bellevue				6.68	
Benkleman				2.12	
Blair	91	35	60.6	7.87	
Bluehill				2.34	
Bradshaw				2.07	
Bridgeport	85	27	56.8	2.74	
Broken Bow	91	26	58.7	5.06	
Burchard				3.68	
Burwell				3.30	
Callaway	94	26	60.0	4.24	
Central City				1.24	
Chester				3.80	
Columbus	91	32	59.6	4.78	
Crete	86	33	61.3	5.74	
Crookston				2.87	T.
Culbertson	96	33	61.8	4.80	
Curtis	92	28	58.4	3.38	
David City	87	31	60.2	5.68	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Dawson	87	36	61.8	7.21	
Edgar				2.14	
Ericson				2.76	
Ewing				4.15	
Fairbury	89	29	60.2	4.33	
Fairmont	88	31	59.8	2.25	
Fort Robinson	84	30	54.0	1.95	T.
Franklin	92[f]	26[f]	60.0[f]	4.43	
Fremont	89	35	60.5	5.10	
Fullerton				4.12	
Geneva	89	32	60.8	2.84	
Genoa (near)	92	35	62.0	6.52	
Gering	87	27	57.4	2.61	
Gothenburg	95	28	60.0	4.23	
Grand Island *b*	94	30	63.2	1.51	
Grant				2.13	
Guide Rock				3.09	
Halsey	88	30	58.6	4.76	
Hartington	87	35	57.2	4.50	
Harvard	90	30	59.8	2.15	
Hastings[*1]	90	40	60.8	1.64	
Hayes Center				4.78	
Hay Spring	80[d]	26[d]	51.6[d]	2.26	T.
Hebron	88	33	60.9	4.49	
Holbrook				4.37	
Holdrege	95	25	60.6	3.90	
Hooper[*1]	92	42	60.6	5.24	
Imperial	91	31	57.4	4.57	0.5
Johnstown				2.42	
Kearney	92	29	60.9	2.78	
Kennedy	89	29	57.2	3.56	
Kimball	84	28	54.8	3.64	
Kirkwood	92	30	59.8	3.10	
Leavitt	88	32	61.4	5.87	
Lexington	92	27	59.0	5.50	
Lockridge	90	32	60.0	1.96	
Lodgepole	84[e]	27[e]	56.2[e]	1.40	
Loup	91	24	59.1	4.19	
Lynch	93	28	61.0	3.11	
McCook				4.62	
McCool Junction				3.33	
Madison	89	32	58.7	4.65	
Madrid	89	24	57.2		
Marquette				1.59	
Mason				5.46	
Minden	91	30	59.5	2.55	
Monroe				5.83	
Nebraska City *c*	88	38	61.8	4.10	
Nemaha				4.30	
Norfolk	90	29	59.6	5.02	
North Loup	93	25	61.0	3.15	
Oakdale	90	30	59.0	2.90	
Odell				5.35	
O'Neil	89	30	58.6	3.31	
Ord				2.76	
Osceola				2.84	
Palmer				2.90	
Palmyra				5.05	
Pawlet				2.56	
Pawnee City	87	34	60.5	5.08	
Plattsmouth *a*				3.74	
Plattsmouth *b*		37		4.34	
Purdum	88	28	57.6	4.60	
Ravenna *a*	92	28	59.8	2.50	
Ravenna *b*				2.28	
Redcloud	91	30	61.0	2.83	
Republican				5.56	
Rulo				4.41	
St. Libory				1.36	
St. Paul	94	29	62.2	1.95	
Santee	91	36	61.8	3.71	
Schuyler				6.79	
Seward	88	34	61.4	3.45	
Smithfield				6.02	
Spragg				5.15	
Springview	88	32	58.8	1.64	
Stanton	91	32	59.8	4.10	
Strang				3.38	
Stratton				4.08	
Stromsburg				2.61	
Superior	86	33	59.0	2.10	
Syracuse				2.41	
Tablerock				4.07	
Tecumseh	91	31	62.2	4.19	
Tekamah	91	37	61.6	5.29	
Turlington	87	35	61.2	3.85	
University Farm	88	35	62.0	4.32	
Wahoo				5.42	
Wakefield	89	32	58.8	3.77	
Wallace				4.20	
Wauneta				3.89	
Weeping Water				3.74	
Westpoint	91	33	61.0	4.73	
Wilber				4.30	
Wilsonville				2.74	
Winnebago	88	28	58.8	4.31	
Wisner				5.21	
Wymore				5.09	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
York	90	42	62.6	2.51	
Nevada.					
Amos	84	25	56.4	0.09	
Austin	76	26[h]	52.4[d]	1.21	8.0
Battle Mountain		30		0.75	
Belmont	81	27	53.0	0.23	1.0
Candelaria	84	34	57.0	0.17	
Carson City	85	28	55.6	0.10	0.1
Cranes Ranch				2.18	
Dyer	89	24	59.0	1.75	
Elko	76	27	48.7	1.55	5.0
Ely	84	26	53.2	2.23	
Eureka	82	10	51.4	T.	
Fallon	85	28	58.4	0.22	
Fenelon[*1]	80	37	53.8		
Geyser	83	20	52.6	1.00	
Glenbrook				0.10	
Halleck[*1]	86	30	52.2	2.01	
Hamilton	76	11	46.8	0.30	3.0
Hawthorne	90	35	60.4	0.00	
Humboldt	84	33	58.6	0.22	2.0
Lewers Ranch	86	28	57.2	0.15	0.5
Lovelocks[*1]	91	31	59.6	T.	
Martins	98	26	60.3	0.21	
Mill City[*1]	84	32	52.6	0.00	
Morey	89	23	54.8	1.50	4.0
Palisade	85	20	53.6	0.70	
Palmetto	82	26	54.2	1.48	3.0
Pioche	87	24	55.8	1.17	
Potts	85	20	50.4	1.77	5.5
Reno State University	84	28	56.0	0.25	
Sodaville	95	30	64.9	T.	
Toano[*5]	81	31	52.1	1.05	
Wabuska	88	26	57.0	0.00	
Wadsworth	88	40	66.6	0.01	
Wells[*1]	79	32	51.6	1.53	
Wood	80	24	52.2	3.02	
New Hampshire.					
Alstead	81	35	58.8	3.59	
Bartlett				5.05	
Berlin Mills	84	26	56.2	2.63	
Bethlehem	81	35	58.3	4.09	
Breton Wood				2.93	
Brookline[*1]	88	33	62.0	4.28	
Chatham	83	29	56.8	4.80	
Concord	86	31	59.8	4.83	
Durham	85	31	59.4	3.29	
Franklin Falls	85	32	60.3	4.44	
Grafton	85	31	59.6	4.17	
Hanover	83	33	59.5	3.35	
Jefferson Highlands				4.46	
Keene	86	32	59.3	2.70	
Nashua	91	35	62.1	2.95	
Newton	86	30	58.3	3.29	
North Woodstock				5.23	
Plymouth	85	32	60.2	5.14	
Stratford	79	28	57.8	4.14	
New Jersey.					
Asbury Park	82	41	58.8	6.69	
Barnegat	86[e]	35[e]	60.4[e]	1.60[e]	
Bayonne	90	39	62.8	1.75	
Belvidere	92	37	64.2	2.93	
Bergen Point	90	41	62.8	1.77	
Beverly	94	41	64.8	3.16	
Blairstown	92	35	62.8	2.97	
Bridgeton	94	40	65.8	1.92	
Canton				1.85	
Cape May C. H	87	39	62.6	1.20	
Charlotteburg	81	31	58.5	3.16	
Chester	86	36	61.8	2.96	
Clayton[b]	92	39	64.2	1.86	
College Farm	94	39	64.0	2.79	
Dover	87	35	60.1	3.19	
Englewood	88	41	62.0	1.63	
Flemington	91	38	63.6	2.88	
Friesburg	90	39	63.2	1.88	
Hightstown	93	40	64.4	3.12	
Imlaystown	95	41	65.3	4.30	
Indian Mills	97	36	64.9	2.02	
Lakewood	90	37	62.2	5.11	
Lambertville	91	37	64.2	2.34	
Layton	89	32	59.8	3.30	
Moorestown	92	40	63.6	3.23	
Newark	90	40	62.7	2.93	
New Brunswick	95	41	65.9	2.83	
Newton	92	34	62.4	3.60	
Oceanic	82	40	60.8	2.69	
Paterson	92	40	65.2	3.07	
Phillipsburg	92	39	63.9	2.88	
Plainfield	89	40	63.3	2.12	
Pleasantville				1.70	
Rancocas				3.88	
Rivervale	88	35	60.6	1.91	
Salem	90	41	65.4	1.51	
Sandy Hook	87	42	61.5	2.50	
Somerville	93	38	63.2	2.38	
South Orange	88	41	62.2	3.11	
Sussex	89	36	62.4	3.90	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
New Jersey—Cont'd.	°	°	°	*Ins.*	*Ins.*
Trenton	91	45	65.5	3.20	
Tuckerton	88	38	62.8	1.45	
Vineland	91	38	63.2	2.10	
Woodbine	88	38	61.0	2.24	
Woodstown	.....	.....	.....	1.89	
New Mexico.					
Alamagordo	99	35	68.4	T.	
Albert	94	34	65.0	1.74	
Albuquerque	90	43	65.0	1.19	
Arabela	91	29	63.6	0.44	
Bellranch	.....	.....	.....	1.02	
Cambray	.....	.....	.....	0.12	
Carlsbad	99°	40°	73.2°	0.57	
Deming	.....	.....	.....	0.00	
Dorsey	83	27	56.2	1.52	
Eagle Rock Ranch	79	27	53.4	2.70	
Engle	91	29	64.8	.....	
Fort Stanton	.....	.....	.....	0.14	
Fort Union	82	21	56.0	0.59	
Fruitland	90	29	59.0	1.10	
Gage	.....	.....	.....	T.	
Golden	.....	.....	.....	0.06	0.6
Las Vegas	86	26	57.6	0.97	
Lordsburg	.....	.....	.....	0.04	
Los Lunas	96	33	65.9	0.40	
Luna	86	24	53.2	0.30	3.0
Maxwell (near)	83	24	57.0	2.34	
Mesilla Park	96	30	68.1	0.05	
Mountainair	86	24	57.6	0.57	
Raton	84	32	57.4	0.73	
Rociada	83°	24°	56.6°	1.71	
Roswell	96	35	67.7	1.30	
San Marcial	97	35	66.0	.....	
San Rafael	91°	25°	57.5°	0.21	T.
Springer	88	27	58.8	0.96	
Strauss	.....	.....	.....	T.	
Taos	87	27	56.7	0.25	
Winsors	74°	17°	47.6°	1.05	
New York.					
Adams	.....	.....	.....	6.83	
Addison	89	28	59.4	4.44	
Akron	.....	.....	.....	2.22	
Alden	84	34	58.4	3.00	
Amsterdam	84	35	60.4	1.63	
Angelica	85	25	57.4	4.00	
Appleton	88	32	56.4	3.21	
Arcade	90	25	55.7	3.77	
Athens	84	40	62.4	1.85	
Atlanta	86	27	56.7	4.39	
Atwater	.....	.....	.....	4.46	
Auburn	85	33	60.5	5.11	
Avon	86	28	58.5	3.94	
Ballston Lake	83	34	60.0	2.32	
Baldwinsville	82	35	60.3	3.62	
Bedford	86	38	61.6	4.06	
Berlin	94	31	60.0	1.67	
Blue Mountain Lake	.....	.....	.....	3.55	
Bolivar	84	24	56.6	4.58	
Bouckville	85	28	59.0	2.49	
Boyds Corners	.....	.....	.....	4.99	
Brockport	88	33	60.3	3.05	
Caldwell	85	34	59.9	2.47	
Canajoharie	85	33	59.4	2.47	
Carmel	84	38	61.7	3.79	
Carvers Falls	84	35	59.0	2.63	
Chazy	81	34	59.5	2.19	
Cooperstown	83	33	57.8	2.40	
Cortland	88	29	59.8	4.03	
Cutchogue	80	36	59.4	2.93	
Deansboro	.....	.....	.....	2.90	
Dekalb Junction	85	33	59.6	2.91	
De Ruyter	84	26	57.1	3.56	
Easton	.....	.....	.....	3.58	
Elba	86	33	59.0	2.28	
Elmira	91	31	62.0	5.00	
Faust	82	25	57.4	2.64	
Fayetteville	88	30	61.3	3.63	
Fort Plain	89	33	61.7	2.88	
Franklinville	84	25	56.2	4.27	
Gabriels	82	25	55.9	2.50	
Gansevoort	.....	.....	.....	2.59	
Glens Falls	83	35	60.4	2.17	
Gloversville	85	35	59.6	2.37	
Greenwich	85	33	60.0	2.32	
Griffin Corners	84	28	55.7	2.45	
Harkness	85	35	59.8	2.56	
Haskinville	.....	.....	.....	3.99	
Hemlock	84	36	59.0	4.55	
Indian Lake	80	23	54.6	2.60	
Ithaca	87	32	59.6	4.64	
Jamestown	85	33	57.7	6.77	
Jeffersonville	84	31	58.6	2.07	
Keene Valley	83	28	58.5	2.81	
Le Roy	86	33	59.6	3.19	
Liberty	82	30	58.6	2.63	
Littlefalls, City Res.	84	32	59.0	2.56	
Lockport	83	33	58.6	2.87	
Lowville	83	29	57.8	2.71	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
New York—Cont'd.	°	°	°	*Ins.*	*Ins.*
Lyndonville	.....	.....	.....	3.51	
Lyons	90	35	62.6	4.05	
Middletown	85	40	61.6	5.80	
Mohonk Lake	79	38	59.9	2.99	
Moira	92	34	60.3	1.77	
Mount Ettrick	84	34	58.8	3.45	
Newark Valley	.....	.....	.....	4.00	
New Lisbon	85	24	55.8	2.62	
North Hammond	84	34	60.5	3.25	
North Lake	.....	.....	.....	5.49	
Number Four	80	27	56.6	3.84	
Ogdensburg	85	38	61.9	2.69	
Old Chatham	.....	.....	.....	2.58	
Oneonta	89	30	60.8	2.82	
Oswegatchie	86	28	59.6	2.56	
Otto	87	35	59.3	3.88	
Oxford	85	30	59.3	3.06	
Oyster Bay	84	40	61.6	2.67	
Palermo	.....	.....	.....	3.96	
Perry City	87	22	58.4	5.61	
Plattsburg Barracks	92	32	60.4	2.25	
Port Jervis	91	38	62.3	4.97	
Potsdam	87	34	60.2	2.52	
Primrose	88	36	61.4	2.18	
Redhook	.....	.....	.....	2.03	
Richmondville	86	34	59.5	1.10	
Ridgeway	83	34	58.4	3.52	
Ripley	87	36	58.2	4.80	
Rome	95	28	61.3	4.18	
Romulus	88	30	60.4	5.17	
Salisbury Mills	.....	.....	.....	4.07	
Saranac Lake	83	29	57.4	1.58	
Saratoga Springs	83	33	59.5	2.10	
Scarsdale	85	37	62.2	1.56	
Scottsville	.....	.....	.....	4.26	
Setauket	83	39	60.3	2.83	
Shortsville	82	31	59.0	3.50	
Skaneateles	.....	.....	.....	3.71	
Southampton	73	36	57.6	2.48	
South Butler	86	30	61.0	3.41	
South Canisteo	86	28	57.9	5.06	
Southeast Reservoir	.....	.....	.....	4.45	
South Kortright	86	26	57.2	2.19	
South Schroon	81	33	57.3	2.85	
Spier Falls	86	36	61.4	1.93	
Straits Corners	88°	25°	58.3°	4.26	
Ticonderoga	82	37	60.6	2.27	
Volusia	81	33	56.0	3.23	
Wappinger Falls	84	38	60.2	5.57	
Warwick	.....	.....	.....	3.12	
Watertown	84	32	59.8	5.17	
Waverly	90	27	60.8	4.02	
Wedgwood	82	33	57.6	5.31	
Wells	83	29	57.2	2.86	
West Berne	85	30°	58.9°	1.84	
Westfield *b*	84	36	58.0	3.89	
Windham	86	33	58.1	3.64	
Youngstown	.....	.....	.....	2.95	
North Carolina.					
Brevard	88	32	60.9	4.74	
Brewers	96	34	62.6	5.86	
Bryson City	.....	.....	.....	2.19	
Currituck	.....	.....	.....	0.94	
Edenton	90	42	67.2	3.03	
Fayetteville	91	45	68.4	2.74	
Goldsboro	92	46	68.4	3.47	
Graham	.....	.....	.....	3.36	
Greensboro	91	43	66.4	3.17	
Henderson	89	49	66.0	2.40	
Hendersonville	87	34	61.3	4.68	
Henrietta	95	42	67.2	3.00	
Highlands	76	29	55.1	7.65	
Horse Cove	81	39	61.2	7.14	
Jefferson	81	33	58.2	10.05	
Kinston	93	43	68.8	3.78	
Kittyhawk	88	52	66.2	1.93	
Lenoir	90	37	64.1	5.11	
Lincolnton	93	41	67.4	2.25	
Linville	76	28	54.1	9.85	
Littleton	89°	46°	65.4°	2.11	
Louisburg	92	46	67.4	3.28	
Lumberton	94	43	69.0	1.60	
Marion	91	33	64.6	6.96	
Moncure	95	41	67.8	3.17	
Monroe	95	38	66.8	2.34	
Morganton	91	37	64.4	4.37	
Mountairy	92	37	63.6	2.42	
Murphy	.....	.....	.....	2.29	
Newbern	88	41	68.3	3.17	
Patterson [1]	86	35	58.2°	8.18	
Pinehurst	91	49	69.0	3.49	
Pittsboro	93	40	66.5	4.94	
Reidsville	89[b]	43[b]	66.2[b]	3.26	
Rockingham	94[1]	47[1]	71.2[1]	2.13	
Salem	89	41	66.1	4.95	
Salisbury	93	40	67.3	1.58	
Saxon	90	39	63.4	3.45	
Selma	94	39	67.6	4.22	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
North Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Settle	92	43	67.2	4.38	
Sloan	90	43	66.6	3.39	
Soapstone Mount	90	43	65.7	5.17	
Southern Pines *a*	94	48	70.2	2.59	
Southern Pines *b*	93	49	69.8	2.55	
Southport	90	49	70.0	2.48	
Statesville	91	38	65.2	2.07	
Tarboro	93	43	68.5	2.04	
Washington	92	44	68.8	1.68	
Waynesville	89	38	62.2	2.00	
Weldon *a*	92	43	67.8	3.75	
Weldon *b*	.....	.....	.....	3.76	
Whiteville	91	42	67.5	3.54	
North Dakota.					
Amenia	84	29	55.5	1.32	
Ashley	89	25	52.6	2.90	.....
Berlin	81	30	52.8	2.11	
Bottineau	82	25	52.5	1.07	T.
Buxton	83	30	55.4	1.68	
Cando	82	28	53.0	1.49	.....
Churchs Ferry	88	30	54.4	1.20	
Coalharbor	83	36	60.4	0.78	
Cooperstown	84	27	53.0	1.61	
Devils Lake	84	30	54.4	2.47	1.0
Dickinson	82	26	54.0	0.90	T.
Donnybrook	83	31	53.7	1.96	T.
Dunseith	86	27	53.7	0.54	
Edgeley	83°	33	53.9	1.29	
Ellendale	85	30	57.2	3.26	
Fargo	83	27	55.1	1.47	
Forman	85	34	56.0	3.03	
Fort Yates	85	30	56.0	1.58	T.
Fullerton	82	31	54.6	2.52	
Glenullin	84	32	53.4	1.43	
Hamilton	85	27	54.4	2.81	
Hannaford	86[d]	27°	55.0[d]	1.10	
Jamestown	85	32	54.8	1.22	
Kulm	81	30	54.2	2.36	
Lamoure	.....	.....	.....	1.63	
Langdon	80	29	52.3	2.23	6.0
Larimore	85	20	52.6	2.08	
Lisbon	84	28	55.0	1.71	
McKinney [e]	81	32	53.2	.....	
Manfred	83	30	54.4	1.81	
Mayville	84	31	54.8	1.69	
Medora	82	29	54.6	0.11	T.
Melville	8[e]	30	53.9	1.30	
Milton	82°	30°	53.8°	1.94	
Minnewaukon	84	30	53.8	1.37	
Minot	92	32	56.8	1.50	
Minto	86	26	53.2	2.70	
Napoleon	81	26	52.6	2.06	T.
New England	78	22	52.0	1.40	T.
Oakdale	80	30	53.8	1.34	T.
Park River	86	26	54.1	1.71	T.
Pembina	87	26	54.6	3.27	
Portal	84[f]	30[f]	54.4[f]	0.70[f]	
Power	84	27	55.6	1.01	
Rolla	81	26	54.2	1.76	T.
Rugby	89[g]	30[g]	53.3[g]	1.06	0.5
Steele	81	28	55.0	1.95	T.
University	82	30	54.4	1.70	
Wahpeton	86	34	58.2	2.83	
Walhalla	86	24	54.2	3.42	0.5
Willow City	82	29	53.9	1.85	
Wishek	93	27	54.6	2.15	
Ohio.					
Akron	88	38	60.2	4.96	
Amesville	94	29	62.8	2.81	T.
Atwater	.....	.....	.....	6.02	
Bangorville	88	31	60.4	3.07	T.
Bellefontaine	86	29	58.6	2.86	T.
Benton Ridge	89	30	60.2	3.14	T.
Bladensburg	89	30	59.4	3.67	T.
Bowling Green	89	30	59.4	3.35	
Bucyrus	88	30	59.5	3.88	
Cadiz	90	35	61.6	3.79	T.
Cambridge	89	30	61.8	3.56	
Camp Dennison	92	33	63.1	5.49	
Canal Dover	91	33	60.6	3.90	
Canton	87	37	60.4	3.45	
Cardington	89	29	59.6	2.84	T.
Circleville	92	32	62.4	3.52	
Clarington	92	33	62.8	3.75	
Clarksville	89	33	62.6	3.64	
Cleveland *a*	86	41	59.6	4.57	
Cleveland *b*	90	40	59.0	3.23	
Clifton	88	32	61.0	3.43	
Coalton	91	29	62.2	3.90	T.
Colebrook	.....	.....	.....	7.01	
Dayton *a*	.....	.....	.....	2.24	
Dayton *b*	89	32	61.6	4.05	
Defiance	89	29	59.4	3.24	T.
Delaware	89	29	59.8	3.63	
Demos	90	36	62.4	3.94	
Elyria	87	36	59.8	5.68	
Findlay	92	32	60.6	4.09	T.
Frankfort	94	31	64.6	2.60	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Ohio—Cont'd.	°	°	°	*Ins.*	*Ins.*
Fremont	90	33	60.6	4.11	
Garrettsville	88	32	57.8	7.62	
Granville	91	31	60.6	2.94	T.
Gratiot	90	30	60.9	3.74	
Green	93	40	63.0	3.42	
Greenfield	89	35	62.6	2.39	
Greenhill	87	31	58.4	3.74	
Greenville	89	31	60.5	4.17	
Hanging Rock	95	34	64.0	2.47	
Hedges	90	27	59.6	3.34	T.
Hillhouse	87	30	56.8	5.31	
Hiram	86	36	59.0	5.86	T.
Hudson	90	34	60.0	6.30	
Jacksonboro	90	37	62.2	4.37	
Kenton	88	30	61.0	3.59	
Killbuck	88	33	60.5	3.75	
Lancaster	91	30	61.6	4.30	
Lima	88	30	61.5	2.91	
McConnelsville	90	30	60.8	4.79	T.
Manara	87	32	60.5	2.79	
Mansfield				3.80	
Marietta	89	35	64.2	2.64	
Marion	91	29	60.4	3.53	T.
Medina	88	33	66.0	3.78	
Milfordton	89	29	59.2	3.54	
Milligan	90	29	60.8	4.12	
Millport	87	32	58.0	2.85	
Montpelier	89	32	59.4	4.56	
Napoleon	83	32	58.2	3.24	T.
Nellie	90	33	61.6	3.61	T.
New Alexandria	91	37	61.1	3.70	
New Berlin	90	36	59.9	4.02	
New Bremen	87	27	60.4	1.55	
New Richmond	90	37	63.8	4.69	
New Waterford	88	34	60.0	3.71	
North Lewisburg	86	31	60.3	2.15	
North Royalton	86	34	59.2	5.20	
Norwalk	94	33	60.6	3.87	
Oberlin	89	33	59.6	4.20	
Ohio State University	88	31	59.9	4.16	
Orangeville	89	35	59.8	4.15	
Ottawa	90	29	60.0	3.67	
Pataskala	90	30	60.3	4.12	T.
Philo	91	35	63.2	3.47	T.
Plattsburg	87	32	60.6	3.19	
Pomeroy	93	34	62.5	2.15	
Portsmouth *a*				2.95	
Portsmouth *b*	92	38	64.2	3.04	
Pulse	87	34	61.8	3.82	
Richwood	89	30	60.0	2.70	
Rittman	91	34	60.6	3.69	
Rockyridge	91	33	60.1	3.67	
Shenandoah	86	30	58.3	3.14	T.
Sidney	90	31	61.4	2.95	
Somerset	92	34	62.6	5.21	
Springfield				2.59	
Thurman	93	36	64.0	3.03	
Tiffin	88	34	59.8	4.36	T.
Upper Sandusky	90	31	60.0	4.07	T.
Urbana	88	29	59.9	2.40	
Vickery	90	30	59.0	3.58	
Warren	91	36	59.8	7.37	
Wauseon	91	29	58.8	3.32	
Waverly	95	32	63.6	3.38	
Waynesville	88	32	61.2	3.65	
Wellington	89	34	60.2	3.71	
Willoughby				3.47	
Wilson	90	32	62.2		
Wooster	88	33	59.4	4.45	
Zanesville				2.22	
Oklahoma.					
Arapaho	94	39	68.5	4.77	
Beaver	95	39	66.4	2.43	
Binger	91[e]	40[e]	67.0[e]	5.93	
Busch				5.00	
Chandler	93	41	67.1	9.13	
Cleo	99	42	69.4		
Cloud Chief	95	40	67.7	5.17	
Eldorado	100	41	73.2	2.60	
Enid	90	41	65.4	5.82	
Fort Reno	91	43	67.2	10.07	
Fort Sill	94	44	69.0	4.80	
Frederick	97	43	71.3	2.63	
Gage	92	38	66.6	2.74	
Grand				5.60	
Guthrie	92	46	66.8	7.59	
Harrington	90	43	66.5	5.87	
Hennessey	88	44	65.4	6.43	
Hobart	93	44	70.2	2.76	
Jefferson	92	40	65.8	6.08	
Jenkins	95	38	66.9	1.71	
Kenton	91	34	63.5	0.99	
Kingfisher	94	44	68.6	5.25	
McComb	91	42	67.9	6.11	
Mangum	95	50	71.9	3.95	
Meeker	95	42	68.6	10.05	
Newkirk	93	42	66.2	7.36	
Norman	92	43	69.0	5.14	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Oklahoma—Cont'd.	°	°	°	*Ins.*	*Ins.*
Pawhuska	92[f]	39[f]	64.1[f]	2.62	
Perry	91	41	65.5	7.22	
Shawnee	92	45	66.9	6.47	
Stillwater	91	42	66.0	7.28	
Taloga	91	36	66.6	3.56	
Temple	96	44	69.8	3.40	
Waukomis	95	41	66.8	5.64	
Weatherford	92	44	65.8	5.07	
Whiteagle	93	42	66.0	6.11	
Woodward	99	42	68.2		
Oregon.					
Albany				0.91	
Alpha	89	32	56.8	1.78	
Arlington	90	35	61.2	0.07	
Ashland	89	34	58.4	0.19	
Astoria	72	40	54.2	1.32	
Aurora (near)	83	32	55.4	0.93	
Bay City	78	34	51.8	1.65	
Bend	83	29	51.2	0.43	
Beulah	86	25	52.3	0.00	
Blackbutte	82	34	53.8	2.20	
Blalock	94	37	65.0	T.	
Bullrun				1.39	
Butter Creek				0.38	
Cascade Locks	82	34	58.0	0.69	
Coquille				0.39	
Corvallis	84	34	56.1	0.76	
Coyote	93[d]	32[d]	61.0[d]	0.37	
Dayville	84	31	56.6	0.81	
Detroit	87	31	55.8	1.95	
Doraville	82	31	53.0	1.66	
Drain	85	34	56.5	1.53	
Ella				0.38	
Eugene	80	36	55.9	2.29	
Fairview	82	33	53.2	1.42	
Falls City	84	32	54.5	0.72	
Forestgrove	93	32	56.3	0.20	
Gardiner	83	31	56.6	2.19	
Glenora	85	29	52.8	1.74	
Gold Beach	79	38	54.7	2.78	
Government Camp	70	24	43.9	2.72	5.0
Grants Pass	94	33	59.0	0.16	
Hood River (near)	84	35	58.3	0.13	
Huntington	87	36	60.4	0.31	
Jacksonville	92	33	60.2	0.38	
Joseph	75	24	50.8	1.50	
Kerby	90	31	57.9	0.32	
Klamath Falls	88	29	58.0	0.45	
Lagrande	83	29	54.4	1.38	
Lakeview	85	25	54.3	0.27	T.
Lonerock	80	25	51.6	1.24	
McKenzie Bridge	88	29	55.8	2.64	
McMinnville	84	32	55.8	0.39	
Meacham				1.05	
Monroe	81	33	56.2	1.32	
Mount Angel	85	39	58.4	0.72	
Nehalem				2.32	
Newport	65	37	50.6	1.68	
Ontario				0.20	
Paisley	83	33	57.6		
Pendleton	94	29	58.8	0.45	
Pine	84	22	52.4	0.54	
Prineville	83[e]	30[e]	55.1[e]	0.58	
Riverside	98	22	55.7	0.45	
Salem	82	38	57.7	0.43	
Sparta	82	24	52.8	1.25	
Stafford	82	34	56.3	0.63	
The Dalles	88	36	59.9	0.09	
Toledo	80	35	53.0	1.78	
Umatilla	93	34	61.9	0.33	
Vale	86	26	55.5	0.48	
Wallowa	80	25	52.6	1.05	
Wamic	86	27	52.8	0.05	
Warm Spring	87	30	57.0	0.37	
Weston	84	25	53.0	1.68	
Williams	90	31	58.3	0.18	
Pennsylvania.					
Altoona	91	30	60.5	2.93	
Beaver Dam				3.50	
Bellefonte	91	38	63.2	3.34	
Brookville				3.90	
Browers				3.27	
California	87	36	60.8	3.68	
Cassandra	87	29	58.1	3.11	
Centerhall	89	32	62.2	2.38	
Clarion				3.92	
Claysville	91	34	61.8	3.74	
Coatesville	91	39	63.8	3.08	
Coudersport	85	32	57.2	4.26	
Confluence				4.03	
Davis Island Dam				3.31	
Derry	87	32	62.0	2.96	
Doylestown				3.41	
Dushore	85	27	59.5	4.94	
East Bloomsburg				3.18	
East Mauch Chunk	94	36	63.3	3.38	
Easton	90	41	64.0	3.00	
Ellwood Junction				2.94	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Pennsylvania—Cont'd.	°	°	°	*Ins.*	*Ins.*
Emporium	88	30	59.8	3.28	
Ephrata	92	35	63.1	3.97	
Everett	89	32	59.8	4.08	
Forks of Neshaminy				3.12	
Frankford	91	40	63.8	4.28	
Franklin	89	29	58.9	6.00	
Freeport	93	34	62.3	3.87	
Gettysburg	91	42	64.5	2.07	
Girardville				4.01	
Gordon	89	29	60.6	3.81	
Greensboro				3.81	
Greenville	90	33	59.4	5.04	
Hamburg	92	37	63.9	4.85	
Hanover	92	37	64.0	2.21	
Herrs Island Dam				2.88	
Huntingdon *a*				2.57	
Huntingdon *b*	93	29	61.2	2.41	
Indiana	88	33	60.4	2.95	T.
Irwin	92	34	62.0	4.76	T.
Johnstown	94	34	62.8	2.98	
Keating				2.32	
Kennett Square	88	39	62.6	3.68	
Lansdale				3.17	
Lawrenceville	91	28	59.8	4.32	
Lebanon	91	38	63.2	5.60	
Leroy	86	34	60.0	5.45	
Lewisburg	90	32	62.9	5.40	
Lockhaven *a*	94	34	63.8	3.66	
Lockhaven *b*				3.65	
Lock No. 4				3.40	
Lycippus	87	36	61.9	4.26	
Marion	89	36	61.4	2.78	
Mifflin				3.85	
Mifflintown	90	31	62.0	4.35	
Milford	90	33	60.8	4.10	
Montrose	86	30	59.6	2.71	
New Germantown	91	32	61.4	3.03	
Oil City				4.39	
Ottsville				4.21	
Parker				3.40	
Philadelphia	92	44	66.4	3.30	
Pocono Lake	83	30	57.0	3.72	
Point Pleasant				3.38	
Pottsville				3.16	
Quakertown	91	38	63.4	3.53	
Reading	92	38	65.0	5.80	
Renovo	91	38	62.0	3.11	
Saegerstown	86	28	57.4	6.22	
St. Marys	84	29	59.4	3.75	
Saltsburg				3.56	
Seisholtzville				4.28	
Selinsgrove	90	34	64.4	6.27	
Shawmont				2.62	
Skidmore	89	32	59.8	4.92	
Smethport	84	21	55.4	4.30	
Smiths Corners				3.32	
Somerset	89	30	57.4	3.46	
South Eaton	88	35	61.2	3.00	
Springmount				4.04	
State College	88	33	60.0	2.10	
Swarthmore	89	38	63.8	2.18	
Towanda	87	31	60.2	4.89	
Troutrun				4.76	
Uniontown	90	37	63.0	3.64	
Warren	86	30	58.2	7.50	
Wellsboro	88	29	60.3		
Westchester	90	41	64.0	5.19	
West Newton				3.42	
Wilkesbarre	91	37	63.2	2.15	
Williamsport	88	37	62.8	5.28	
Rhode Island.					
Bristol	73	39	58.3	3.01	
Kingston	81	35	57.8	3.17	
Providence *a*	87	42	64.6	2.37	
Providence *c*	85	38	61.1	2.49	
South Carolina.					
Aiken	98	47	71.4	1.65	
Allendale	94	51	72.7	0.60	
Anderson	96	45	70.2	1.57	
Barksdale	98	47	71.7	3.86	
Batesburg	91	48	69.6	2.88	
Beaufort	91	53	72.0	0.42	
Bennettsville	94	50	73.8	0.40	
Blackville	97	47	71.7	1.86	
Bowman	96	45	70.8	2.50	
Calhoun Falls				3.39	
Camden				1.46	
Cheraw *a*	92	47	69.0	1.70	
Cheraw *b*				1.87	
Clarks Hill	97	48	70.8	2.46	
Clemson College	97	39	67.2	2.08	
Conway	93	45	68.8	2.40	
Darlington	95	45	69.9	4.36	
Dillon	95	43	70.6	1.69	
Due West	92	45	70.8	3.29	
Effingham				1.27	
Florence	95	45	71.0	2.10	
Gaffney	99	45	70.5	1.84	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
South Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Gillisonville	94	48	70.6	1.93	
Greenville	90	40	65.0	1.93	
Greenwood	96	47	70.4	3.05	
Heath Springs	93	42	69.0	2.56	
Kingstree *a*	91	48	69.5	0.90	
Kingstree *b*				0.88	
Liberty	96	38	69.6	3.35	
Little Mountain	95	49	70.7	2.78	
Lugoff	98	45	70.2	1.94	
Newberry	97	46	70.7	2.76	
St. Georges	92	50	71.1	0.83	
St. Matthews	90	50	70.1	1.46	
St. Stephens				1.40	
Saluda	96	41	69.7	2.31	
Santuck	97	41	69.0	1.75	
Scivern	97	42	69.8	2.16	
Smiths Mills				2.35	
Society Hill	90	50	70.0	2.83	
Spartanburg	97	44	69.5	2.07	
Statesburg	98	51	71.2	3.31	
Summerville	93	48	69.9	2.77	
Sumter	97	48	72.4	0.23	
Trenton	94	50	71.2	2.17	
Trial	94	42	69.8	1.56	
Walhalla	95	40	66.7	4.67	
Walterboro	93	47	70.5	1.21	
Winnsboro	92	54	71.2	3.12	
Winthrop College	95	48	70.0	0.87	
Yemassee	93	50	71.1	1.94	
Yorkville	98	48	71.2	2.62	
South Dakota.					
Aberdeen	82	32	57.4	3.79	
Academy	90	35	59.8	0.90	
Alexandria	90	34	58.3	1.69	
Armour	90	31	61.9	3.49	
Asheroft	84	28	54.4	0.92	
Bowdle	82	28	55.1	3.65	
Brookings	85	30	55.0	1.82	
Canton	88	30	57.6	2.44	
Cavite	91*	25*	59.0*	0.76	
Centerville				1.06	
Chamberlain	90	31	60.0	0.91	
Cherrycreek	87	28	58.7	1.37	
Clark	86	30	56.4	1.68	
Clear Lake	87	34	56.2	2.12	
Desmet	84	29	54.9	1.93	
Doland	82	32	56.6	3.32	
Elkpoint	92	34	60.6	3.23	
Fairfax	89	31	60.8	1.86	
Farmingdale				4.16	
Faulkton	85	29	55.8	4.08	
Flandreau	86	33	56.7	2.45	
Forestburg	87	34	58.2	3.68	
Fort Meade	82	32	56.4	4.52	T.
Gannvalley	91	27	58.0	1.14	
Grand River School	86	28	55.8	2.24	
Greenwood	91	35	61.1	3.87	
Highmore	89	31	57.4	0.99	
Hitchcock				3.54	
Hotch City	91	26	58.6	0.41	
Howard	86	32	57.1	2.41	
Howell	88	27	56.4	2.97	
Ipswich	84	28	55.4	4.29	
Kidder	82	23	54.3	2.20	
Kimball	88	25	57.8	1.20	
Leola	82	32	56.4	3.94	
Marion	88	30	58.1	1.95	
Mellette	84	32	56.6	2.42	
Menno	91*	35*	60.0*	2.03	
Millbank	88	30	57.2	1.85	T.
Mitchell	88	34	58.6	2.45	
Oelrichs	89	29	54.8	3.30	
Pedro	85	27	57.2	1.77	
Pine Ridge	85	27	55.8	2.52	
Plankinton	88	29	57.8	2.55	
Ramsey	87	22	56.6	2.58	
Redfield	85	31	55.8	2.04	
Rosebud	89	29	60.5	1.65	
Silver City				4.32	T.
Sioux Falls	90	29	57.9	2.31	
Sisseton Agency	85	31	54.8	2.77	T.
Spearfish	79	33	53.4	2.49	
Stephan	91	27	57.9	0.79	T.
Tyndall	89	28	59.2	4.28	
Vermillion	90	34	60.8	3.28	
Watertown	84	31	53.6	1.34	
Wentworth	87	32	57.0	2.51	
Wolsey				4.02	
Tennessee.					
Andersonville	92	36	64.2	3.46	
Arlington	93	42	66.8	4.09	
Ashwood	90	43	65.7	5.61	
Benton	94	38	66.0	3.43	
Bluff City				2.24	
Bolivar	93	44	66.3	3.66	
Bristol	87	37	63.1	2.23	
Brownsville	92	45	68.2	2.53	
Byrdstown	89	37	64.6	5.65	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Tennessee—Cont'd.	°	°	°	*Ins.*	*Ins.*
Carthage	93	40	65.4	4.04	
Catlettsburg				2.66	
Cedar Hill	93	45	67.0	4.80	
Celina				4.69	
Charleston				3.40	
Clarksville	99	41	66.2	2.55	
Clinton				3.82	
Covington	90	47	68.2	4.18	
Decatur	93	37	65.2	4.77	
Dickson	89	37	64.6	3.52	
Dover	91	38	65.4	2.77	
Dyersburg	90	40	67.4	3.36	
Elizabethton	92	39	65.0	3.71	
Erasmus	89	33	60.4	5.17	
Florence	91	39	66.2	3.55	
Franklin	91	40	65.2	5.11	
Grace				6.90	
Greeneville	89	38	64.6	3.24	
Halls Hill				2.71	
Harriman	90	41	65.4	4.85	
Hohenwald	97	30	63.2	5.12	
Iron City	91	37	65.0	4.45	
Isabella	90	39	64.8	3.47	
Jackson	92	37	65.9	3.29	
Johnsonville	94	37	66.2	3.51	
Jonesboro				3.26	
Kenton	90	38	65.8	2.32	
Kingston				4.12	
Lafayette	91	36	63.4	3.21	
Leadvale				2.20	
Lebanon	92	34	65.4	3.54	
Lewisburg	94	38	67.0	3.09	
Lynnville	90	40	65.4	4.27	
McMinnville	92	41	65.0	6.18	
Maryville	94	38	66.2	2.55	
Milan	93	41	67.2	2.98	
Monterey	88	38	63.2	3.51	
Newport	89	42	66.6	3.10	
Palmetto	91	39	66.8	4.13	
Pope	95	35	66.6	5.10	
Rogersville	92	37	64.9	2.13	
Rugby	90	30	61.5	5.30	
Savannah	95	40	68.2	5.68	
Sewanee	89	39	64.4	6.22	
Silverlake	84	32	59.1	3.72	
Springdale	91	35	64.8	3.63	
Springville	94	35	65.8	2.55	
Tazewell				2.80	
Tellico Plains	93	38	66.2	3.63	
Tracy City	91	34	62.4	3.64	
Trenton	93	39	70.1	3.17	
Tullahoma	94	36	65.0	5.51	
Waynesboro	92	37	65.9	5.48	
Wildersville	87	42	66.0	3.57	
Yukon	96	41	68.2	3.40	
Texas.					
Albany	97	44	73.0	2.91	
Alvin	92	56	74.4	5.54	
Arthur				5.76	
Austin	95	50	74.4	11.37	
Ballinger	98	48	72.0	0.91	
Beaumont	96	56	75.8	4.85	
Beeville	95	54	75.0	3.97	
Bigspring	99	43	73.6	3.40	
Blanco	92	43	69.4	4.09	
Boerne	91	46	69.6	8.28	
Bonham	93	47	70.4	5.93	
Booth				7.41	
Bowie	95	46	71.1	3.98	
Brazoria	93	52	72.9	7.07	
Brenham	92	54	73.4	6.09	
Brighton	87	58	76.2	6.92	
Brownwood	99	48	72.6	1.70	
Burnet	90	51	71.2	3.82	
Childress	99[1]	49[1]	70.4[1]	2.30	
Clarendon	94	46	71.5	6.67	
Claytonville	99	49	74.2	1.63	
Coleman	92	50	71.0	5.47	
College Station		50		5.99	
Colorado	101	42	75.2	2.01	
Columbia	92	55	73.6	7.08	
Columbus				5.75	
Comanche	96	46	70.3	3.29	
Comstock	98	53	75.0	3.38	
Corsicana	95	50	74.4	6.44	
Cotullo	103	58	81.5	2.26	
Cuero	96	53	75.5	6.03	
Dallas	95	47	71.0	4.41	
Danevang	95	54	74.6	7.85	
Dialville	91	53	71.8	3.61	
Dublin	91	49	69.8	2.09	
Duval	90	53	71.8	6.05	
Eastland	93[f]	45[f]	71.4[f]	4.26	
Estelle	93	49	71.4	4.96	
Fort Brown	99	58	78.1	0.83	
Fort Clark	99	55	75.2	2.30	
Fort Davis	93	40	67.8	1.12	
Fort McIntosh	101	53	79.8	0.96	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Texas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Fort Ringgold	102	53	79.6	10.15	
Fort Stockton				4.66	
Fredericksburg	95	46	72.0	4.31	
Gainesville	89	45	68.4	5.15	
Gatesville		48[1]	71.2[1]	3.72	
Graham	98	46*	73.0	3.36	
Grapevine	93	50	71.7	4.15	
Greenville	95	48	70.8	4.15	
Hale Center	96	46	67.6	4.27	
Hallettsville	95	53	75.1	5.42	
Haskell	101	48	74.2	2.93	
Hearne	98	48	72.6	7.92	
Hempstead				5.40	
Henrietta	95	47	71.0	4.90	
Hewitt				6.68	
Hillsboro	95	47	72.2	4.85	
Hondo	97	51	74.2	5.28	
Houston	97	53	75.0	4.90	
Huntsville	95	49	74.0	6.46	
Ira	100	45	72.8	2.45	
Jasper	93	50	72.1	2.10	
Jefferson	88	46	70.0	2.69	
Jewett	91	47	72.5	3.67	
Junction				3.79	
Kaufman	97	51	73.0	4.55	
Kent	98	44	69.8	2.22	
Kerrville	99	41	70.7	3.96	
Knickerbocker	97	41	72.6	3.25	
Kopperl				4.84	
Lampasas	94	44	71.0	6.52	
Lapara				5.29	
Laureles Ranch				6.32	
Liberty	95	56	70.8	4.00	
Llano	94	56	71.9	5.30	
Longview	95	49	72.6	4.82	
Luling	92	46	71.8	6.34	
McKinney				4.57	
Mann	96*	48*	73.4*	5.76	
Marlin	95	50	72.4	4.78	
Menardville	93	39	70.2	3.84	
Midland	86	45	66.4	2.65	
Mount Blanco	98	39	69.3	2.26	
Nacogdoches	91	46	71.6	2.71	
New Braunfels	92	52	72.6	7.06	
Orange				3.60	
Panter				4.01	
Paris	93	46	70.4	4.14	
Pearsall	99	52	76.0	3.00	
Pecos	98	40	67.8	1.00	
Port Lavaca	89	60	75.0	6.56	
Rhineland	97	40	71.4	2.70	
Riverside				5.37	
Rockisland	93	53	73.6	7.73	
Rockland				6.76	
Rockport	86	60	71.4	3.07	
Runge	98[d]	50[d]	75.2[d]	3.65	
Sabinal	96	51	71.4	7.03	
San Marcos	94	49	72.6	7.74	
San Saba	94	44	71.3	4.81	
Santa Gertrudes Ranch				5.33	
Sherman	88	54	71.8	1.80	
Sonora	95	46	72.0	2.76	
Sugarland	93	53	69.6	4.82	
Sulphur Springs	90	49	70.2	4.56	
Temple *a*	91	51	70.6	6.15	
Temple *b*	95	49	73.0	6.20	
Tilden	100	51	76.6	4.89	
Trinity	97	49	73.6	5.06	
Tulia	95	37	66.0	2.86	
Tyler	94	49	72.4	4.16	
Vernon	97[d]	47[d]	74.3[d]	2.55	
Victoria	96	55	75.4	4.37	
Waco	98	51	74.7	7.11	
Waxahachie	96	45	71.6	4.20	
Weatherford	95	48	72.4	3.74	
Wharton	95	53	74.0	10.44	
Wichita Falls				4.02	
Utah.					
Alpine				1.92	
Aneth	90	34	63.3	0.62	
Blackrock	85	29	56.0	1.64	
Bluecreek	81	40	62.2	1.07	
Callao	89	27	56.8	0.77	
Castledale	81	23	52.2	1.00	
Cisco	94	32	64.6	1.33	
Corinne	86	30	57.6	0.91	
Coyoto	85	21	48.5	0.17	
Deseret	87	26	54.6	2.13	
Emery	69	15	49.4	0.74	
Experiment Farm	96	31	63.8		
Farmington	85	29	55.2	3.05	
Fillmore	89	32	58.4	2.81	
Fort Duchesne	90*	25	58.2*	2.78	
Frisco	85	30	55.2	2.49	
Garrison	87	25	56.6	0.97	
Giles	79	31	56.0	0.62	
Government Creek	78	26	53.2	1.53	
Green River	92	34	63.8	0.97	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Utah—Cont'd.	°	°	°	*Ins.*	*Ins.*
Heber	81	23	52.8	2.01	
Henefer	80	22	52.2	2.57	
Hite	94	41	68.1	0.84	
Huntsville	.....	.....	.....	1.88	
Ibapah	86	20	51.6	1.81	
Kanab	85[c]	16[c]	55.6[c]	0.90	
Kelton	82[d]	26[d]	55.0[d]	0.25	
Levan	79	31	53.8	3.13	
Loa	80	25	53.2	0.19	
Logan	77	32	56.2	0.85	
Lund	86	32	58.4	1.33	.....
Manti	82[d]	30[d]	53.3[d]	2.03	
Marysvale	84	27	53.8	1.69	0.5
Meadowville	75	26	50.3	1.55	T.
Millville	.....	.....	.....	1.65	
Moab	94	33	64.2	1.41	
Monticello	80	29	52.6	1.67	4.0
Morgan	80	25	52.7	3.66	
Mount Nebo	83	32	57.3	2.11	
Mount Pleasant	82	29	54.4	2.11	
Ogden	82	31	58.7	1.96	
Park City	84	24	52.5	2.44	6.5
Parowan	83	25	55.6	2.07	3.0
Payson	.....	.....	.....	2.41	
Pinto	79	24	51.5	1.90	0.3
Plateau	78	22	49.8	3.11	6.5
Promontory *[1]	82	35	55.0	.....	
Provo	86	29	57.9	2.11	
Ranch	80	18	52.8	1.80	
Richfield	88	28	56.4	1.03	
Rockville	100	38	69.6	1.05	
St. George	96	27	64.8	0.35	
Salt Air	82	43	59.1	2.17	
Scipio	84	24	55.1	2.01	
Snowville	80	23	52.2	0.65	
Soldier Summit	76	18	46.2	2.22	
Terrace	86	29	56.9	0.07	0.7
Thistle	95	28	57.2	2.65	
Tooele	83	38	58.2	3.84	
Tropic	83	31	55.6	1.25	
Wellington	86	29	56.8	1.66	
Woodruff	85	20	50.5	2.53	
Vermont.					
Burlington	77	42	61.0	2.99	
Cavendish	83	32	58.7	2.87	
Chelsea	77	35	56.5	2.69	
Cornwall	82	41	61.6	3.30	
Enosburg Falls	83	28	58.4	3.21	
Jacksonville	81	30	56.1	2.52	
Manchester	82	35	58.5	4.08	
Morrisville	84	29	60.2	3.01	
Norwich	83	32	58.4	3.10	
St. Johnsbury	85	30	60.4	3.64	
Wells	80	36	58.6	3.76	
Woodstock	84	32	57.6	2.93	
Virginia.					
Ashland	93	42	66.8	1.75	
Barboursville	90	43	65.4	4.05	
Bedford	.....	36	.....	3.75	
Bigstone Gap	92	30	62.8	3.90	
Blacksburg	86	32	58.8	2.38	
Burkes Garden	81	32	56.0	4.76	
Callaville	90	45	67.8	2.11	
Charlottesville	91	45	66.7	3.63	
Clarksville	.....	.....	.....	3.95	
Columbia	95	41	65.8	4.45	
Dale Enterprise	89	38	61.1	3.16	
Danville	96	42	67.4	2.01	
Elk Knob	86	37	63.2	3.12	
Farmville	92	40	65.6	4.90	
Fredericksburg	91	39	64.4	2.13	
Hampton	87	47	66.2	2.91	
Hot Springs	84	33	59.0	5.80	
Lexington	90	36	63.0	4.15	
Lincoln	92	37	63.8	3.75	
Marion	87[c]	31[c]	61.0[c]	2.60	
McDowell	90	32	60.2	2.29	
Mendota	.....	.....	.....	2.09	
Mount Weather	83	38	60.2	4.37	
Newport News	90	48	68.1	3.09	
Petersburg	92	34	68.4	1.24	
Quantico	91	38	65.3	.....	
Radford	.....	.....	.....	1.70	
Riverton	.....	.....	.....	3.25	
Roanoke	90	37	66.0	4.50	
Rockymount	82	39	59.4	4.79	
Saxe	90	40	65.4	2.62	
Shenandoah	.....	.....	.....	2.85	
Speers Ferry	.....	.....	.....	3.98	
Spottsville	92	39	65.0	2.92	
Stanardsville	89	38	60.5	2.15	
Staunton	90	39	62.6	2.76	
Stephens City	93	35	63.8	4.94	
Warsaw	91[c]	41[d]	66.1[d]	1.98	
Wilkerson	92	42	65.2	2.34	
Woodstock	95	38	64.2	2.89	
Wytheville	87	36	60.8	2.92	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Washington.	°	°	°	*Ins.*	*Ins.*
Aberdeen	87	33	52.5	0.47	
Anacortes	.....	.....	.....	0.88	
Ashford	.....	.....	.....	2.34	
Bellingham	73	32	53.0	0.72	
Blaine	72	24	52.0	1.34	
Brinnon	80	38	52.8	1.77	
Cedonia	81	32	55.4	0.54	
Centralia	87	29	53.8	0.94	
Cheney	80	26	53.2	1.38	
Clearbrook	80	31	52.0	1.57	
Clearwater	81	32	51.1	4.43	
Cle Elum	79	26	50.2	0.29	T.
Colfax	79	28	52.0	0.53	
Colville	86	26	53.8	0.43	
Conconully	86	29	54.4	0.11	
Connell	.....	.....	.....	0.20	
Coupeville	80	39	54.0	0.60	
Crescent	79	28	53.2	0.34	
Danville	85	28	54.0	0.63	
East Sound	76[1]	31[1]	52.3[1]	0.91	
Ellensburg	82	29	53.6	T.	
Ephrata	87	32	59.0	0.10	
Grandmound	82	28	52.6	0.78	
Granite Falls	.....	.....	.....	3.26	
Horseheaven	.....	.....	.....	0.39	
Kennewick	94	31	61.0	0.13	
Lacenter	82	34	55.2	1.63	
Lakeside	80	32	58.1	0.05	
Lester	77	30	51.6	1.72	
Lind	80	35[c]	56.7[c]	0.47	
Loomis	82	32	58.1	0.00	
Mottinger Ranch	93	36	62.2	0.43	
Mount Pleasant	79	34	55.1	1.32	
Moxee	89	26	56.7	T.	
Northport	85	25	53.1	0.52	
Odessa	87	31	58.4	0.17	
Olga	72	35	52.6	0.63	
Olympia	85	31	54.6	0.69	
Pinehill	85	32	57.2	0.19	
Port Townsend	75	39	52.6	0.58	
Pullman	76	34	53.2	0.71	
Rattlesnake	81	32	53.2	0.43	
Republic	81	25	50.8	0.26	
Ritzville	.....	.....	.....	0.20	
Ritzville (near)	.....	.....	.....	0.10	
Rosalia	79	31	52.8	0.36	
Sedro-Woolley	80	35	53.8	0.98	
Silvana	80	32	51.6	0.65	
Snohomish	81	33	52.8	1.19	
Snoqualmie	80	32	53.5	1.98	
Southbend	74	33	51.6	0.82	
South Ellensburg	84	30	54.6	T.	
Sprague	.....	.....	.....	0.20	
Sunnyside	87	30	57.0	0.10	
Trinidad	89	35	61.4	0.00	
Twisp	87	30	55.0	T.	
Union	84[c]	32[b]	53.9[c]	1.32	
Vancouver	83	34	56.6	1.16	
Vashon	78	38	53.8	0.82	
Waterville	80	22	52.5	0.05	
Wenatchee (near)	84	31	55.8	0.01	
Wilbur	80	24	52.0	0.34	
Zindel	88	38	62.0	1.22	
West Virginia.					
Bayard	87	28	56.4	3.80	
Bens Run	90	35	63.0	2.21	
Berkeley Springs	90	36	62.0	4.55	
Beverly	89	32	58.9	3.69	
Bluefield	85	37	63.9	1.58	
Buckhannon	92	36	61.8	2.97	
Burlington	91	32	61.2	3.41	
Cairo	96	30	63.1	1.82	
Central	94	30	61.6	1.99	
Chapel	88	44	67.4	3.15	
Charleston	92	41	66.3	2.72	
Creston	90	36	61.6	1.54	
Cuba	91	34	62.9	2.12	
Doane	91	38	64.6	3.42	
Elkhorn	88	36	61.8	2.65	
Fairmont	.....	.....	.....	3.10	
Grafton	91	30	61.8	2.60	
Green Sulphur Springs	90	33	61.0	4.09	
Harpers Ferry	.....	.....	.....	3.44	
Hinton	.....	.....	.....	3.53	
Huntington	94	36	64.6	3.04	
Leonard	80	32	57.2	5.80	
Lewisburg	88	31	60.2	5.23	
Lillydale	89	32	61.1	3.89	
Logan	92	40	65.6	4.62	
Lost Creek	90	30	59.4	3.95	
Marlinton	84	31	57.4	3.43	T.
Mannington	92	30	61.3	3.29	
Martinsburg	93	39	63.4	5.48	
Moorefield	95	35	63.4	3.01	
Morgantown	89	34	63.0	2.91	
Moundsville	89	34	61.4	3.26	
New Cumberland	89	38	60.9	3.49	
New Martinsville	94	33	64.0	1.97	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
West Virginia—Cont'd.	°	°	°	*Ins.*	*Ins.*
Nuttallburg	94	30	63.0	2.35	
Parsons	90	30	58.7	4.46	
Philippi	92	30	61.0	2.47	
Pickens	88	35	59.0	4.84	.....
Point Pleasant	88	41	63.4	2.31	
Powellton	92	25	57.5	2.88	
Princeton	87	36	60.4	4.55	
Romney	94	33	62.4	2.38	
Rowlesburg	.....	.....	.....	2.87	
Ryan	98	32	64.4	2.32	
Southside	92	42	65.8	2.67	
Terra Alta	92	32	59.6	4.42	
Uppertract	91	31	61.0	3.63	
Valley Fork	90	38	63.6	3.30	
Wellsburg	87	36	60.8	4.26	
Weston *a*	.....	.....	.....	2.50	
Weston *b*	93	33	64.4	4.33	
Wheeling *a*	.....	.....	.....	3.25	
Wheeling *b*	90	42	67.4	4.52	
Williamson	95	39	65.8	5.32	
Wisconsin.					
Amherst	84	29	55.7	7.15	
Antigo	80[c]	29	53.1[c]	8.60	
Appleton	83	33	57.1	5.96	
Appleton Marsh	85	26	55.0	4.71	
Ashland	.....	.....	.....	1.09	
Barron	86	26	54.2	6.55	
Beloit	84	36	58.8	2.88	
Brodhead	87	31	58.4	2.96	
Burnett	82	32	56.0	6.01	
Chilton	83	31	56.4	7.10	
Chippewa Falls	.....	.....	.....	0.26	
Citypoint	85	34	58.6	5.22	
Darlington	86	27	57.6	1.66	
Dodgeville *e*	85	31	56.9	1.35	
Downing	84	25	53.2	4.72	
Easton	87	28	56.5	6.68	
Eau Claire	85	31	57.8	2.52	
Florence	83	22	52.7	4.29	T.
Fond du Lac	86	31	56.6	5.67	
Grand Rapids	82	28	57.2	6.97	
Grand River Locks	.....	.....	.....	5.54	
Grantsburg	85	25	54.6	3.08	
Hancock	83	28	56.0	6.74	
Harvey	85	33	58.3	3.12	
Hayward	82[c]	20[c]	51.8[c]	2.60	
Hillsboro	85	29	55.2	5.52	
Koepenick	90	24	53.7	6.90	
Lancaster	85	33	57.8	4.83	
Madison	81	34	57.4	5.03	
Manitowoc	83	34	53.2	5.21	
Meadow Valley	85	26	57.0	4.71	
Medford	84	28	55.2	5.95	
Menasha	.....	.....	.....	5.93	
Minocqua	79	27	52.4	3.30	T.
Mount Horeb	85	28	56.2	3.32	
Neillsville	86	28	55.7	4.91	
New London	83	30	55.8	6.81	
Oconto	83	32	55.2	8.47	
Osceola	85	25	54.7	5.21	
Oshkosh	84	30	56.8	6.05	
Pine River	87	28	56.6	5.65	T.
Portage	86	31	58.6	4.91	
Port Washington	83	28	51.0	3.81	
Prairie du Chien *a*	90	33	60.8	4.74	
Prairie du Chien *b*	.....	.....	.....	4.72	
Prentice	82	28	53.6	4.60	
Racine	85	34	55.4	1.33	
Sheboygan	86	33	53.7	3.83	
Spooner	89	22	56.9	2.55	
Stanley	84	29	55.4	3.39	
Stevens Point	85	28	56.7	7.33	
Tomahawk[d]	81	27	52.6	4.62	T.
Valley Junction	85	27	57.4	5.64	
Viroqua	82	30	56.6	5.92	
Washburn	85	32	63.3	1.78	T.
Watertown	85	32	57.0	4.51	
Waukesha	84	34	56.4	3.70	
Waupaca	82	29	56.2	6.50	
Wausau	81	28	54.4	4.71	
Whitehall	84	25	55.8	4.93	
Wyoming.					
Afton	76	24	49.2	1.64	
Alcova	82	28	52.5	2.84	T.
Basin	88	29	57.1	0.58	T.
Battle	60	15	38.0	1.80	18.0
Bedford	74	22	46.9	2.36	.....
Border	76	23	48.7	1.05	.....
Buffalo	78	24	49.6	2.79	T.
Centenial	.....	.....	.....	3.31	
Chugwater	80	24	51.4	5.10	
Daniel	70	18	43.2	1.18	T.
Embar	91	16	53.4	3.72	
Evanston	72	22	46.6	2.88	1.5
Fort Laramie	85	25	53.2	3.63	
Fort Washakie	82	26	52.4	4.18	
Griggs	82	26	51.6	3.83	T.
Hyattville	85	24	54.9	.....	.....

TABLE II.—*Climatological record of voluntary and other cooperating observers. Late reports for April*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Wyoming—Cont'd.	°	°	°	*Ins.*	*Ins.*
Kimball Ranch	77[c]	29[c]	51.6[c]	.....	
Laramie	73	20	46.8	1.74	T.
Leo	74	22	47.8	1.24	6.0
Lolabama Ranch	70	17	43.3	1.89	1.0
Lusk	83	24	51.5	2.71	
Marquette	80	26	52.0	1.22	
Moore	79[c]	26[c]	50.2[c]	3.41	
Phillips	79	24	52.4	4.75	
Pine Bluff	83	25	53.2	4.08	T.
Rawlins	85	20	52.9	1.91	.....
Red Bank	79	27	50.0	3.67	T.
Rock Springs	79	19	51.2	1.32	
South Pass	72	21	44.8	2.00	20.0
Tensleep	85[c]	30[c]	52.6[c]	1.80	T.
Thayne	76	20	47.2	1.86	.....
Thermopolis	80	28	51.8	5.80	
Wells	66	14	41.0	0.71	T.
Yellowstone Pk. (G.Can.)	62	9	39.2	.....	
Yellowstone Pk. (Lake)	72	13	41.3	0.73	3.0
Yellowstone Pk. (Foun'n)	66	19	41.4	0.85	.....
Yellowstone Pk. (U. Ba'n)	67	15	41.6	1.22	.....
Yellowstone Park (Norris)	70[c]	11[c]	41.2[c]	0.94	T.
Porto Rico.					
Adjuntas	86	52	71.3	2.35	
Aguirre	92	67	79.6	4.26	
Arecibo	91	57	72.6	3.17	
Barros	87	56	71.8	1.04	
Bayamon	92	60	77.1	.....	
Caguas	90	62	76.7	2.53	
Canovanas	93	70	80.6	2.08	
Cayey	85	59	73.0	1.75	
Cidra	88	.....	.....	8.97	
Coamo	89	51	70.9	3.30	
Corozal	92	51	71.8	2.16	
Fajardo	89	68	79.6	3.26	
Guanica	88	61	75.0	2.70	
Hacienda Colosa	90	62	76.4	15.71	
Hacienda Josefa	.....	.....	.....	6.90	
Hacienda Perla	90	70	79.6	10.36	
Humacao	89	74	82.0	5.20	
Isabela	87	63	76.2	7.09	
Juan Diaz	90	61	75.6	3.42	
La Carmelita	83	61	71.9	7.04	
La Isolina	90	62	75.8	5.01	
Lares	91	58	74.8	7.00	
Las Marias	88	63	76.0	6.85	
Manati	97	63	78.8	3.10	
Maunabo	93	67	79.6	6.13	
Mayaguez	90	61	77.2	4.05	
Morovis	91	63	76.8	1.20	
Ponce[g]	89	63	78.9	2.19	
Rio Blanco	89	62	77.8	10.29	
Rio Piedras	.....	.....	.....	6.18	
San Lorenzo	91	63	77.6	5.58	
San Salvador	88	60	73.4	2.13	
Porto Rico—Cont'd.					
Santa Isabel	89	65	77.8	7.91	
Vieques	91	61	75.5	2.10	
Yauco	87	70	79.2	3.33	
Mexico.					
Coatzacoalcos	99	49	80.1	3.84	
Leon de Aldamas	90	52	70.5	2.34	
New Brunswick.					
St. John	68	33	51.1	2.98	

Late reports for April, 1904.

Alaska.					
Coal Harbor	45	14	31.2	2.29	9.4
Coldfoot	56	−19	27.0	0.70	7.0
Copper Center	58	8	34.2	0.24	1.5
Fort Gibbon	54	−12	26.2	0.09	2.0
Fort Liscum	52	22	36.2	4.50	16.1
Fort Yukon	.....	−14	.....	3.08	4.8
Kenai	55	.....	.....	0.34	3.0
Mine Harbor	45	3	27.7	1.42	27.0
Sunrise	56	20	35.4	5.08	21.6
Wood Island	48	24	37.4	3.68	14.0
California.					
Boca[*1]	72	16	32.8	0.05	0.5
Jolon	.....	.....	.....	1.77	
Ventura	86	44	60.1	1.53	
Florida.					
Fort Pierce	90	45	72.4	1.92	
Iowa.					
Villisca	73	21	45.1	4.58	.....
Michigan.					
Thomaston	66	− 8	31.2	.....	.....
Minnesota.					
Campbell	74	19	38.4	3.08	4.0
Nevada.					
Elko	74	25	44.2	1.29	4.0
New Mexico.					
Carlsbad	98[4]	31[4]	65.0[4]	0.00	
Engle	86	29	57.8	.....	
Luna	80	14	47.0	0.10	1.0
North Carolina.					
Brewers	82	19	50.0	1.57	T.
Pinehurst	84	31	58.0	0.85	
North Dakota.					
Langdon	73	8	33.6	0.92	T.
South Dakota.					
Mellette	80	12	41.7	2.29	8.0
Washington.					
Silvana	75	30	49.6	3.35	
Wyoming.					
Thayne	55[c]	2[c]	33.4[c]	0.84	4.0
Porto Rico.					
Adjuntas[d]	85	51	69.4	5.62	

EXPLANATION OF SIGNS.

* Extremes of temperature from observed readings of dry thermometer.

A numerical following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. + 4.
[2] Mean of 8 a. m. + 8 p. m. + 2.
[3] Mean of 7 a. m. + 7 p. m. + 2.
[4] Mean of 6 a. m. + 6 p. m. + 2.
[5] Mean of 7 a. m. + 2 p. m. + 2.
[6] Mean of readings at various hours reduced to true daily mean by special tables.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance, "[a]" denotes 14 days missing.

No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks of whatever duration, in the precipitation record receive appropriate notice.

TABLE III.—*Resultant winds from observations at 8 a. m. and 8 p. m., daily, during the month of May, 1904.*

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
New England.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Eastport, Me	15	26	18	18	s.	11
Portland, Me	19	29	9	13	s. 22 w.	11
Concord, N. H. †	12	8	8	10	n. 27 w.	4
Northfield, Vt	16	36	8	10	s. 6 w.	20
Boston, Mass	17	19	15	27	s. 81 w.	12
Nantucket, Mass	11	31	14	23	s. 24 w.	22
Block Island, R. I	11	23	16	29	s. 47 w.	18
Narragansett, R. I.*	3	17	6	12	s. 23 w.	15
New Haven, Conn	21	24	18	15	s. 45 w.	4
Middle Atlantic States.						
Albany, N. Y	17	30	8	15	s. 28 w.	15
Binghamton, N. Y. †	10	5	12	8	n. 39 e.	6
New York, N. Y	14	20	21	18	s. 27 e.	7
Harrisburg, Pa	9	20	24	20	s. 20 e.	12
Philadelphia, Pa	17	26	12	21	s. 45 w.	13
Scranton, Pa	20	24	14	19	s. 51 w.	6
Atlantic City, N. J	13	26	16	22	s. 25 w.	14
Cape May, N. J	13	26	17	17	s.	13
Baltimore, Md	11	28	17	19	s. 7 w.	17
Washington, D. C	16	27	17	15	s. 10 e.	11
Cape Henry, Va. †	7	14	13	6	s. 45 e.	10
Lynchburg, Va	15	24	15	22	s. 38 w.	11
Norfolk, Va	17	27	21	10	s. 48 w.	15
Richmond, Va	17	27	19	15	s. 22 w.	11
Wytheville, Va	13	16	20	24	s. 53 w.	5
South Atlantic States.						
Asheville, N. C	19	23	22	14	s. 63 w.	9
Charlotte, N. C	16	24	23	11	s. 56 w.	14
Hatteras, N. C	17	21	20	16	s. 45 e.	6
Kittyhawk, N. C.*						
Raleigh, N. C	19	21	19	19	s.	2
Wilmington, N. C	16	23	19	16	s. 23 e.	8
Charleston, S. C	21	23	18	12	s. 72 e.	6
Columbia, S. C	15	22	21	16	s. 36 w.	9
Augusta, Ga	17	22	22	16	s. 50 e.	8
Savannah, Ga	15	26	16	17	s. 5 w.	11
Jacksonville, Fla	18	23	30	10	s. 76 e.	21
Florida Peninsula.						
Jupiter, Fla	12	19	30	15	s. 65 e.	17
Key West, Fla	16	16	36	3	e.	33
Sand Key, Fla. †	9	8	21	2	n. 87 e.	19
Tampa, Fla	25	6	23	24	n. 3 w.	19
Eastern Gulf States.						
Atlanta, Ga	15	21	20	14	s. 45 e.	8
Macon, Ga. †	14	10	7	5	n. 27 e.	4
Pensacola, Fla. †	12	6	12	8	n. 34 e.	7
Birmingham, Ala. †	10	8	12	8	n. 63 e.	4
Mobile, Ala	25	25	7	14	w.	7
Montgomery, Ala	22	19	16	17	n. 18 w.	3
Meridian, Miss. †	10	10	7	9	w.	2
Vicksburg, Miss	18	21	19	14	s. 59 e.	6
New Orleans, La	19	26	20	14	s. 41 e.	9
Western Gulf States.						
Shreveport, La	15	27	23	13	s. 40 e.	16
Fort Smith, Ark	14	13	29	17	n. 85 e.	12
Little Rock, Ark	20	18	16	24	n. 76 w.	8
Corpus Christi, Tex	4	31	43	1	s. 57 e.	50
Fort Worth, Tex	14	31	25	9	s. 43 e.	23
Galveston, Tex	11	40	15	7	s. 15 e.	30
Palestine, Tex	16	30	18	9	s. 33 e.	17
San Antonio, Tex	15	28	35	4	s. 67 e.	34
Taylor, Tex. †	6	16	12	2	s. 45 e.	14
Ohio Valley and Tennessee.						
Chattanooga, Tenn	12	23	15	26	s. 45 w.	16
Knoxville, Tenn	24	16	16	23	n. 41 w.	11
Memphis, Tenn	24	21	15	19	n. 53 w.	5
Nashville, Tenn	24	17	16	22	n. 41 w.	9
Lexington, Ky. †	3	13	11	9	s. 11 e.	10
Louisville, Ky	17	22	18	18	s.	5
Evansville, Ind. †	11	10	9	10	n. 45 w.	1
Indianapolis, Ind	21	22	16	17	s. 45 w.	1
Cincinnati, Ohio	13	19	22	21	s. 9 e.	6
Columbus, Ohio	13	21	23	19	s. 27 e.	9
Pittsburg, Pa	21	21	11	25	w.	14
Parkersburg, W. Va	15	20	18	21	s. 31 w.	6
Elkins, W. Va	18	24	4	25	s. 74 w.	22
Lower Lake Region.						
Buffalo, N. Y	7	36	10	22	s. 22 w.	31
Oswego, N. Y	11	29	13	21	s. 24 w.	20
Rochester, N. Y	7	28	11	31	s. 44 w.	29
Syracuse, N. Y	12	26	8	21	s. 43 w.	19
Erie, Pa	10	20	14	27	s. 52 w.	16
Cleveland, Ohio	17	26	19	16	s. 18 e.	10
Sandusky, Ohio †	6	12	8	11	s. 27 w.	7
Toledo, Ohio	14	20	18	24	s. 45 w.	8
Detroit, Mich	19	21	13	23	s. 79 w.	10
Upper Lake Region.						
Alpena, Mich	23	16	22	19	n. 23 e.	8
Escanaba, Mich	31	18	13	11	n. 9 e.	13
Grand Rapids, Mich	17	22	18	21	s. 31 w.	6
Houghton, Mich. †	6	2	15	13	n. 27 e.	4
Marquette, Mich	28	15	12	23	n. 40 w.	17
Port Huron, Mich	19	22	17	20	s. 45 w.	4
Sault Ste. Marie, Mich	14	15	14	31	s. 87 w.	17
Chicago, Ill	23	22	18	16	n. 63 e.	2
Milwaukee, Wis	24	14	16	21	n. 27 w.	11
Green Bay, Wis	25	19	19	11	n. 53 e.	10
Duluth, Minn	35	4	24	16	n. 14 e.	32
North Dakota.						
Moorhead, Minn	22	20	22	17	n. 68 e.	5
Bismarck, N. Dak	27	17	20	10	n. 45 e.	14

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
North Dakota—Continued.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Williston, N. Dak	23	19	23	15	n. 63 e.	9
Upper Mississippi Valley.						
Minneapolis, Minn.*	8	8	9	12	w.	3
St. Paul, Minn	20	16	22	19	n. 37 e.	5
La Crosse, Wis †	13	10	7	7	n.	3
Davenport, Iowa	19	18	20	18	n. 63 e.	2
Des Moines, Iowa	19	19	19	19		
Dubuque, Iowa	20	21	18	20	s. 63 w.	2
Keokuk, Iowa	21	17	16	22	n. 56 w.	7
Cairo, Ill	20	24	15	17	s. 27 w.	4
Springfield, Ill	18	18	20	19	e.	1
Hannibal, Mo. †	9	8	9	12	n. 72 w.	3
St. Louis, Mo	21	20	20	15	n. 79 e.	5
Missouri Valley.						
Columbia, Mo. *	11	10	9	9	n.	1
Kansas City, Mo	19	20	22	20	s. 63 e.	2
Springfield, Mo	18	24	20	17	s. 27 e.	7
Topeka, Kans.*	8	12	9	3	s. 56 e.	7
Lincoln, Nebr	18	28	17	11	s. 31 e.	12
Omaha, Nebr	20	18	20	14	n. 72 e.	6
Valentine, Nebr	25	16	13	23	n. 48 w.	14
Sioux City, Iowa †	13	10	9	8	n. 18 e.	3
Pierre, S. Dak	22	16	21	18	n. 27 e.	7
Huron, S. Dak	20	19	20	19	n. 45 e.	1
Yankton, S. Dak. †	6	7	15	11	s. 76 e.	4
Northern Slope.						
Havre, Mont	18	20	15	29	s. 82 w.	14
Miles City, Mont	24	14	17	23	n. 31 w.	12
Helena, Mont	15	15	4	38	w.	34
Kalispell, Mont	12	19	9	36	s. 75 w.	28
Rapid City, S. Dak	20	12	11	30	n. 67 w.	21
Cheyenne, Wyo	24	20	10	23	n. 73 w.	14
Lander, Wyo	24	13	13	27	n. 52 w.	18
Yellowstone Park, Wyo	21	28	3	26	s. 73 w.	24
North Platte, Nebr	16	22	14	21	s. 49 w.	9
Middle Slope.						
Denver, Colo	21	24	15	14	s. 18 w.	3
Pueblo, Colo	24	13	26	16	n. 42 e.	15
Concordia, Kans	13	27	18	14	s. 16 e.	15
Dodge, Kans	17	24	27	12	s. 65 e.	17
Wichita, Kans	14	27	22	8	s. 47 e.	19
Oklahoma, Okla	19	29	19	6	s. 52 e.	16
Southern Slope.						
Abilene, Tex	15	31	29	3	s. 58 e.	30
Amarillo, Tex	12	31	20	14	s. 18 e.	20
Southern Plateau.						
El Paso, Tex	18	11	19	29	n. 55 w.	12
Santa Fe, N. Mex	12	27	22	16	s. 22 e.	16
Flagstaff, Ariz	19	19	6	35	w.	29
Phoenix, Ariz	15	11	27	24	n. 37 e.	5
Yuma, Ariz	12	28	8	26	s. 48 w.	24
Independence, Cal	25	9	5	37	n. 63 w.	36
Middle Plateau.						
Carson City, Nev	19	17	7	32	n. 85 w.	25
Winnemucca, Nev	27	10	16	27	n. 33 w.	20
Modena, Utah	14	11	16	32	n. 79 w.	16
Salt Lake City, Utah	32	15	16	14	n. 7 e.	17
Grand Junction, Colo	27	16	19	19	n.	11
Northern Plateau.						
Baker City, Oreg	25	23	15	20	n. 68 w.	5
Boise, Idaho	23	14	13	29	n. 61 w.	18
Lewiston, Idaho †	1	3	18	10	s. 76 e.	8
Pocatello, Idaho	4	14	22	30	s. 39 w.	13
Spokane, Wash	14	27	12	19	s. 28 w.	15
Walla Walla, Wash	7	32	18	16	s. 5 e.	25
North Pacific Coast Region.						
North Head, Wash	30	10	8	33	n. 51 w.	32
Port Crescent, Wash*	12	2	5	21	n. 58 w.	19
Seattle, Wash	22	14	19	18	n. 7 e.	8
Tacoma, Wash	27	17	8	21	n. 52 w.	16
Tatoosh Island, Wash	8	16	15	35	s. 68 w.	22
Portland, Oreg	23	17	13	26	n. 65 w.	14
Roseburg, Oreg	31	5	23	14	n. 19 e.	28
Middle Pacific Coast Region.						
Eureka, Cal	35	9	6	21	n. 30 w.	30
Mount Tamalpais, Cal	31	5	2	39	n. 55 w.	45
Red Bluff, Cal	38	15	11	7	n. 10 e.	23
Sacramento, Cal	21	30	9	15	s. 18 w.	20
San Francisco, Cal	3	12	2	50	s. 79 w.	49
Point Reyes Light, Cal*	18	4	0	20	n. 55 w.	24
Southeast Farallon, Cal*	16	3	1	21	n. 57 w.	24
South Pacific Coast Region.						
Fresno, Cal	42	2	4	30	n. 33 w.	48
Los Angeles, Cal	3	20	16	32	s. 43 w	23
San Diego, Cal	13	20	8	33	s. 74 w.	26
San Luis Obispo, Cal	19	19	3	26	w.	23
West Indies						
Basseterre, St. Kitts, W. I						
Bridgetown, Barbados						
Cienfuegos, Cuba						
Colon, Colombia, S. A. †						
Curaçoa, W. I						
Grand Turk, W. I. †	2	13	22	1	s. 62 e.	24
Hamilton, Bermuda	14	33	13	10	s. 9 e.	19
Havana, Cuba †	1	3	30	0	s. 86 e.	30
Kingston, Jamaica						
Port of Spain, Trinidad †						
Puerto Principe, Cuba						
Roseau, Dominica, W. I. †						
San Juan, Porto Rico	3	33	44	1	s. 55 e.	52
Santiago de Cuba, Cuba						

* From observations at 8 p. m. only. † From observations at 8 a. m. only.

TABLE IV.—*Thunderstorms and auroras, May, 1904.*

States.	No. of stations.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total. No.	Total. Days.	
Alabama	60	T.	2	....	....	....	2	....	4	2	....	....	....	....	2	....	....	4	....	....	....	....	....	....	....	1	....	2	3	1	6	15	4	48	13	T.
		A.																																0	0	A.
Arizona	56	T.	1	1	....	....	....	....	....	1	2	5	4	5	6	3	....	....	....	....	....	1	3	....	4	1	....	....	....	....	....	....	....	37	13	T.
		A.																																0	0	A.
Arkansas	57	T.	10	....	....	5	4	12	4	5	1	....	....	....	3	....	1	6	15	1	....	....	....	1	1	....	1	13	3	8	17	3	....	114	20	T.
		A.																																0	0	A.
California	167	T.	1	1	1	1	....	....	1	....	....	....	....	....	2	....	1	....	2	1	1	1	3	6	5	....	1	2	....	1	....	....	....	31	17	T.
		A.																																0	0	A.
Colorado	70	T.	7	17	8	9	1	3	6	....	....	....	....	....	1	4	9	8	....	4	6	8	12	....	5	15	14	8	4	5	5	2	8	169	24	T.
		A.																																0	0	A.
Connecticut	21	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	6	1	....	....	....	....	13	12	8	....	....	10	3	56	8	T.
		A.																																0	0	A.
Delaware	5	T.	2	....	....	....	....	....	....	....	3	3	....	....	....	....	1	....	....	2	....	....	....	....	....	....	....	1	1	....	....	1	1	15	9	T.
		A.																																0	0	A.
Dist. of Columbia	4	T.	....	....	....	....	....	....	....	....	1	....	....	....	1	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	3	3	T.
		A.																																0	0	A.
Florida	61	T.	5	12	2	1	7	4	1	2	2	6	2	1	....	7	2	10	11	6	2	1	....	....	1	....	1	....	3	6	2	8	13	118	26	T.
		A.																																0	0	A.
Georgia	67	T.	....	7	2	....	....	....	2	1	2	....	....	....	....	8	1	....	2	....	....	....	....	....	....	1	....	1	2	2	13	19	21	84	15	T.
		A.																																0	0	A.
Idaho	34	T.	....	1	....	1	....	1	....	....	....	....	....	....	....	....	....	....	1	3	6	2	....	....	1	....	....	....	....	....	4	10	3	33	11	T.
		A.																																1	1	A.
Illinois	84	T.	....	....	2	....	10	27	20	11	16	....	1	9	5	....	....	....	....	3	....	....	....	10	24	19	2	12	1	....	6	....	....	178	17	T.
		A.																																0	0	A.
Indiana	58	T.	....	4	15	....	4	3	4	5	16	1	....	2	1	....	....	....	1	1	....	....	....	....	29	19	2	20	2	....	18	6	2	155	20	T.
		A.																																0	0	A.
Indian Territory	20	T.	2	....	3	1	3	4	....	2	....	....	....	1	5	....	1	4	....	....	3	1	....	....	....	....	2	1	2	3	5	1	1	45	19	T.
		A.																																0	0	A.
Iowa	128	T.	....	....	....	1	21	11	15	3	3	1	1	21	3	1	1	2	1	1	....	....	1	14	4	40	35	7	....	2	4	....	3	196	24	T.
		A.																																0	0	A.
Kansas	88	T.	6	1	16	23	21	6	12	13	....	....	2	10	1	2	13	7	....	1	1	7	9	1	5	6	23	9	2	15	10	3	18	243	28	T.
		A.																																0	0	A.
Kentucky	41	T.	....	1	1	....	....	....	....	3	....	....	....	....	1	....	....	....	....	....	....	....	....	....	13	4	1	5	1	....	13	10	1	54	12	T.
		A.																																0	0	A.
Louisiana	46	T.	15	2	..	....	5	6	4	2	2	....	....	....	3	....	1	12	2	....	....	....	....	....	....	....	....	1	8	8	11	2	2	86	17	T.
		A.																																0	0	A.
Maine	25	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	5	6	....	8	1	1	3	6	5	1	1	1	....	39	12	T.
		A.																																0	0	A.
Maryland	42	T.	14	5	....	....	....	....	1	....	20	6	....	....	....	13	2	1	....	11	4	....	....	....	....	1	2	12	3	....	....	12	6	113	16	T.
		A.																																0	0	A.
Massachusetts	48	T.	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	4	....	3	18	16	....	....	....	....	22	21	18	....	....	3	....	107	9	T.
		A.																																2	2	A.
Michigan	106	T.	....	....	....	1	....	7	7	8	2	....	2	1 6	1 3	....	....	....	....	1	1	1	2	17	15	4	15	9	1	....	5	....	....	107	19	T.
		A.																																0	0	A.
Minnesota	67	T.	....	....	....	....	20	5	15	1	....	....	....	....	....	....	....	....	1	....	1	....	7	16	6	9	4	4	....	1	....	7	5	102	15	T.
		A.																																0	0	A.
Mississippi	57	T.	4	..	....	2	1	4	3	5	....	....	....	....	2	1	....	5	....	....	1	....	....	....	....	....	....	....	6	3	10	10	....	57	14	T.
		A.																																0	0	A.
Missouri	86	T.	1	....	....	28	24	27	10	4	11	....	....	11	3	....	4	3	9	5	1	....	1	16	15	5	19	17	....	15	24	9	4	266	24	T.
		A.																																0	0	A.
Montana	54	T.	2	2	....	2	....	1	....	....	....	2	1	....	....	6	....	....	....	2	....	1	....	....	....	....	....	....	....	....	9	10	13	51	12	T.
		A.														1																		7	3	A.
Nebraska	137	T.	2	1	4	15	23	1	14	4	....	....	....	2 17	4	1	8	7	....	....	1	4	5	3	2	22	22	1	6	26	6	13	49	256	24	T.
		A.																																0	0	A.
Nevada	40	T.	....	....	....	....	....	....	....	....	....	....	....	....	3	1	....	....	....	....	1	3	2	1	1	6	1	2	....	....	....	....	....	21	10	T.
		A.																																0	0	A.
New Hampshire	21	T.	....	....	....	....	....	....	....	....	....	2	....	....	..	....	2	4	....	....	6	5	1	2	....	....	14	10	....	....	....	1	....	47	10	T.
		A.																																0	0	A.
New Jersey	48	T.	10	....	....	....	....	....	....	....	8	13	....	....	....	1	4	....	....	5	....	....	....	....	....	14	15	6	1	....	....	27	9	113	12	T.
		A.																																0	0	A.
New Mexico	31	T.	....	1	....	....	1	1	....	....	....	....	1	3	2	....	1	1	....	2	2	4	6	2	3	....	2	3	3	....	....	....	....	38	17	T.
		A.																																0	0	A.
New York	129	T.	....	....	....	....	....	....	....	3	1	1	....	....	....	13	1	....	....	....	40	3	2	....	26	4	69	42	10	....	....	7	....	222	14	T.
		A.																																0	0	A.
North Carolina	56	T.	2	11	5	....	2	1	1	3	18	11	....	....	....	11	....	....	10	23	....	....	....	1	....	9	5	1	10	4	8	12	15	163	21	T.
		A.																																0	0	A.
North Dakota	48	T.	3	....	....	....	5	7	2	2	....	....	4	1	....	....	....	....	....	....	....	1	4	....	....	....	....	2	....	1	....	8	....	40	12	T.
		A.												1	2																			9	6	A.
Ohio	101	T.	....	4	12	1	....	1	....	2	....	3	1	....	7	2	....	....	1	1 12	3	1	1	....	48	25	44	45	2	....	15	13	18	260	22	T.
		A.																					1											1	1	A.
Oklahoma	36	T.	2	....	12	....	8	1	2	1	....	....	....	3	9	1	7	3	....	1	2	1	1	....	....	....	5	....	4	10	6	....	3	82	20	T.
		A.																																0	0	A.
Oregon	70	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	5	1	....	....	....	....	1	3	1	1	....	....	5	....	2	20	9	T.
		A.																																1	1	A.
Pennsylvania	91	T.	6	10	2	....	....	....	....	2	9	5	....	....	....	16	17	2	1	12	11	....	....	....	15	6	24	32	7	....	1	15	20	213	20	T.
		A.																																0	0	A.
Rhode Island	6	T.	1	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1	3	1	....	....	....	....	5	1	2	....	....	2	1	18	10	T.
		A.																																0	0	A.
South Carolina	54	T.	1	9	2	....	....	....	4	3	8	4	....	....	....	14	3	....	4	5	2	....	1	....	....	....	....	....	4	2	10	15	21	112	18	T.
		A.																																0	0	A.
South Dakota	56	T.	2	....	....	....	6	....	2	1	1	1	1	....	....	....	1	1	1	....	1	2	5	4	1	7	1	....	1	2	1	12	5	59	22	T.
		A.												1	1																			2	2	A.
Tennessee	56	T.	1	4	12	4	2	1	5	5	6	....	....	....	10	3	....	1	3	....	....	....	....	....	1	1	3	8	6	....	17	15	11	119	21	T.
		A.																																0	2	A.
Texas	126	T.	14	10	32	15	11	27	1	4	4	....	2	2	11	....	8	10	18	1	4	2	1	....	....	2	3	7	11	18	16	3	....	237	26	T.
		A.																																0	0	A.
Utah	64	T.	2	5	4	2	....	....	....	....	....	....	....	....	7	14	1	....	....	1	10	10	2	2	2	16	4	13	6	....	....	3	....	104	18	T.
		A.																																0	0	A.
Vermont	12	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	3	....	....	6	....	1	9	4	....	....	....	....	....	25	6	T.
		A.																																0	0	A.
Virginia	40	T.	1	4	1	....	....	1	....	....	20	4	....	....	....	11	3	....	5	17	3	....	....	....	....	6	7	1	6	1	2	8	19	120	19	T.
		A.																																0	0	A.
Washington	71	T.	....	1	....	....	1	1	....	....	1	....	1	....	1	....	....	....	3	1	....	....	1	1	....	4	....	1	1	1	2	1	....	22	16	T.
		A.														1																		1	1	A.
West Virginia	47	T.	1	7	4	....	....	....	....	....	8	....	....	....	....	1	....	....	3	11	....	....	....	....	9	10	8	16	5	....	7	14	10	114	15	T.
		A.																																0	0	A.
Wisconsin	63	T.	....	....	....	....	10	7	16	5	....	....	4	12	1	1	1	1	....	....	....	....	1	17	10	18	14	3	....	....	4	....	....	125	17	T.
		A.																																0	0	A.
Wyoming	38	T.	4	5	5	2	....	2	1	1	....	2	....	....	....	8	....	....	....	8	9	8	5	....	1	2	1	....	2	....	9	7	12	94	20	T.
		A.																		1	1	1	....	....	....	....	....	....	....	....	....	....	....	3	3	A.
Sums	2993	T.	124	126	145	114	192	172	157	104	165	70	30	104	92	143	94	97	99	151	158	91	76	128	249	282	417	362	160	136	272	318	303	5,131	....	T.
		A.	0	0	0	0	0	0	0	0	0	0	0	6	8	4	0	0	0	2	1	1	1	0	1	0	0	0	0	2	0	1	0	27	....	A.

TABLE V.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour during May, 1904, at all stations furnished with self-registering gages.*

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Albany, N. Y	25	4:18 p. m.	6:40 p. m.	0.66	4:21 p. m.	4:35 p. m.	0.01	0.40	0.54	0.58	.....	.....	.....	.....	.....	.....	.....	0.47	.....	.....	.....
Alpena, Mich	24–25	.....	.....	0.80	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.47	.....	.....	.....
Amarillo, Tex	20–21	9:30 p. m.	1:50 a. m.	1.20	11:50 p. m.	12:15 a. m.	0.35	0.06	0.19	0.41	0.59	0.67	.....	.....	.....	.....	.....	.....	.....	.....	.....
Asheville, N. C	25	2:10 p. m.	3:05 p. m.	0.56	2:22 p. m.	2:40 p. m.	T.	0.12	0.28	0.45	0.52	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Atlanta, Ga	29	7:50 p. m.	11:20 p. m.	0.60	8:20 p. m.	8:35 p. m.	T.	0.23	0.35	0.43	0.45	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Atlantic City, N. J	27	.....	.....	0.30	.....	.....	.....	.....	0.29	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Augusta, Ga	14	.....	.....	0.18	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.18	.....	.....	.....
Baltimore, Md	30	.....	.....	0.38	.....	.....	.....	.....	.....	0.29	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Binghamton, N. Y	19	.....	.....	0.55	.....	.....	.....	.....	.....	0.47	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Birmingham, Ala	7	.....	.....	1.36	.....	.....	.....	.....	.....	0.48	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Bismarck, N. Dak	11	.....	.....	0.41	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.13	.....	.....	.....
Block Island, R. I	30–31	.....	.....	0.75	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.39	.....	.....	.....
Boise, Idaho	†	.....	.....	0.33	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.09	.....	.....	.....
Boston, Mass	27	.....	.....	0.31	.....	.....	.....	0.29	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Buffalo, N. Y	31	.....	.....	0.63	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.41	.....	.....	.....
Cairo, Ill	5	.....	.....	0.71	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.30	.....	.....	.....	.....	.....	.....
Charleston, S. C	7	.....	.....	0.51	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.47	.....	.....	.....
Charlotte, N. C	7	5:45 p. m.	6:45 p. m.	0.58	5:47 p. m.	6:05 p. m.	T.	0.24	0.43	0.52	0.56	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Chattanooga, Tenn	29	.....	.....	0.58	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.55‡	.....	.....	.....
Cheyenne, Wyo	20	4:05 p. m.	8:25 p. m.	1.11	6:10 p. m.	6:50 p. m.	0.04	0.06	0.09	0.11	0.24	0.26	0.35	0.68	0.92	.....	.....	.....	.....	.....	.....
Chicago, Ill	8–9	.....	.....	0.59	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.31	.....	.....	.....
Cincinnati, Ohio	30–31	.....	.....	1.42	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.40	.....	.....	.....
Cleveland, Ohio	31	.....	.....	1.36	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.43	.....	.....	.....
Columbia, Mo	6	.....	.....	0.81	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.54	.....	.....	.....
Columbia, S. C	14	.....	.....	0.26	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.21	.....	.....	.....
Columbus, Ohio	17–18	.....	.....	0.74	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.52	.....	.....	.....
Concord, N. H	25	.....	.....	0.48	.....	.....	.....	.....	0.37	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Corpus Christi, Tex	6	8:32 a. m.	9:27 a. m.	1.15	8:38 a. m.	9:03 a. m.	0.01	0.08	0.34	0.61	0.97	1.12	.....	.....	.....	.....	.....	0.25	.....	.....	.....
Davenport, Iowa	6–7	.....	.....	1.33	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Denver, Colo	2–3	.....	.....	1.56	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.51	.....	.....	.....
Des Moines, Iowa	25–26	.....	.....	1.45	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.32	.....	.....	.....
Detroit, Mich	26	5:25 p. m.	6:45 p. m.	0.63	5:46 p. m.	6:15 p. m.	T.	0.07	0.13	0.33	0.48	0.54	0.57	0.59	0.62	.....	.....	.....	.....	.....	.....
Dodge, Kans	31	4:53 p. m.	8:30 p. m.	1.66	5:52 p. m.	6:57 p. m.	0.03	0.06	0.12	0.24	0.34	0.42	0.54	0.72	0.93	1.08	1.23	1.48	.....	.....	.....
Dubuque, Iowa	22	4:15 p. m.	8:10 p. m.	1.13	6:05 p. m.	6:43 p. m.	0.09	0.07	1.17	0.29	0.48	0.61	0.62	0.71	0.92	.....	.....	.....	.....	.....	.....
Duluth, Minn	5–6	.....	.....	0.62	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	*	.....	.....	.....
Eastport, Me	11–12	.....	.....	1.28	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.23	.....	.....	.....
Elkins, W. Va	18	.....	.....	0.83	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.52	.....	.....	.....
Erie, Pa	30–31	.....	.....	1.63	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.27	.....	.....	.....
Escanaba, Mich	29	3:24 p. m.	3:40 p. m.	0.71	3:25 p. m.	3:35 p. m.	T.	0.42	0.71	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Evansville, Ind	26	.....	.....	0.24	.....	.....	.....	.....	.....	.....	0.24	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Fort Smith, Ark	29	12:01 a. m.	6:23 a. m.	0.90	4:28 a. m.	4:55 a. m.	0.06	0.10	0.13	0.28	0.54	0.62	0.64	0.68	0.70	.....	.....	.....	.....	.....	.....
Fort Worth, Tex	3	1:04 p. m.	7:30 p. m.	1.85	2:32 p. m.	3:15 p. m.	0.02	0.17	0.61	0.73	0.85	1.00	1.03	1.05	1.13	1.17	.....	.....	.....	.....	.....
Do	5–6	8:15 p. m.	6:00 a. m.	0.88	10:02 p. m.	10:20 p. m.	0.03	0.30	0.57	0.66	0.68	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Galveston, Tex	4	12:35 a. m.	8:10 a. m.	2.55	12:45 a. m.	1:45 a. m.	0.02	0.11	0.34	0.55	0.77	0.93	1.05	1.10	1.17	1.23	1.25	1.38	.....	.....	.....
Do	6	9:40 a. m.	1:20 p. m.	1.05	9:50 a. m.	10:20 a. m.	T.	0.12	0.36	0.48	0.54	0.62	0.69	.....	.....	.....	.....	.....	.....	.....	.....
Grand Junction, Colo	24	.....	.....	0.46	.....	.....	.....	.....	.....	.....	.....	.....	0.44	.....	.....	.....	.....	.....	.....	.....	.....
Grand Rapids, Mich	22	8:25 p. m.	11:30 p. m.	2.17	9:02 p. m.	11:06 p. m.	T.	0.06	0.24	0.43	0.52	0.61	0.65	0.70	0.75	0.80	0.86	0.93	1.32	1.71	2.03
Green Bay, Wis	7–8	.....	.....	0.61	.....	.....	.....	.....	.....	.....	0.51	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hannibal, Mo	6	5:30 p. m.	7:25 p. m.	1.15	6:21 p. m.	7:09 p. m.	0.05	0.07	0.20	0.34	0.42	0.50	0.65	0.71	0.87	1.04	1.10	.....	.....	.....	.....
Harrisburg, Pa	30–31	7:22 p. m.	D. N.	1.31	8:29 p. m.	9:11 p. m.	0.03	0.19	0.38	0.50	0.52	0.53	0.63	0.67	0.71	0.75	.....	.....	.....	.....	.....
Hatteras, N. C	10	.....	.....	0.68	.....	.....	.....	.....	.....	0.42	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Huron, S. Dak	30	7:45 p. m.	9:15 p. m.	0.53	8:11 p. m.	8:32 p. m.	0.03	0.05	0.15	0.27	0.47	0.49	.....	.....	.....	.....	.....	.....	.....	.....	.....
Indianapolis, Ind	30	9:12 a. m.	5:40 p. m.	0.83	1:40 p. m.	2:10 p. m.	0.06	0.09	0.31	0.40	0.49	0.54	0.58	.....	.....	.....	.....	.....	.....	.....	.....
Jacksonville, Fla	18	1:35 p. m.	2:15 p. m.	0.72	1:35 p. m.	1:45 p. m.	0.00	0.58	0.68	0.71	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	31	12:02 p. m.	2:00 p. m.	1.17	12:06 p. m.	12:29 p. m.	T.	0.34	0.53	0.78	1.07	1.15	.....	.....	.....	.....	.....	.....	.....	.....	.....
Jupiter, Fla	17	12:15 p. m.	12:45 p. m.	0.58	12:16 p. m.	12:28 p. m.	T.	0.29	0.51	0.56	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Kalispell, Mont	11	.....	.....	0.25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.08	.....	.....	.....
Kansas City, Mo	5	2:45 p. m.	10:30 p. m.	3.88	3:02 p. m.	3:50 p. m.	0.01	0.16‡	0.31‡	0.43‡	0.49	0.56	0.58	0.62	0.68	0.86	0.88	.....	.....	.....	.....
					4:15 p. m.	6:00 p. m.	0.91	0.19	0.27	0.33	0.45	0.59	0.68	0.74	0.78	0.79	0.90	1.04	1.43	1.62	.....
Key West, Fla	5	7:05 p. m.	10:30 p. m.	0.94	7:50 p. m.	8:15 p. m.	0.03	0.08	0.25	0.51	0.67	0.75	0.78	.....	.....	.....	.....	.....	.....	.....	.....
Do	19	12:35 a. m.	6:55 p. m.	5.83	6:55 a. m.	8:05 a. m.	2.00	0.06	0.20	0.37	0.52	0.63	0.71	0.77	0.81	0.87	0.96	1.04	1.25	.....	.....
Knoxville, Tenn	31	.....	.....	0.35	.....	.....	.....	.....	.....	.....	.....	0.32	.....	.....	.....	.....	.....	.....	.....	.....	.....
La Crosse, Wis	25–26	.....	.....	1.03	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.42	.....	.....	.....
Lewiston, Idaho	18	.....	.....	0.33	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.09	.....	.....	.....
Lexington, Ky	29–30	.....	.....	1.08	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	*	.....	.....	.....
Lincoln, Nebr	15–16	.....	.....	1.14	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.21	.....	.....	.....
Little Rock, Ark	6–7	.....	.....	1.79	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.69	.....	.....	.....
Los Angeles, Cal	25	.....	.....	T.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Louisville, Ky	29	.....	.....	0.84	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.47	.....	.....	.....
Lynchburg, Va	9	.....	.....	0.41	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.35	.....	.....	.....
Macon, Ga	30	.....	.....	0.52	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.50	.....	.....	.....
Memphis, Tenn	29–30	11:50 p. m.	D. N.	1.86	12:38 a. m.	12:47 a. m.	0.05	0.31	0.54	0.55	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
					3:37 a. m.	4:11 a. m.	0.96	0.20	0.38	0.44	0.52	0.58	0.78	0.90	.....	.....	.....	.....	.....	.....	.....
Meridian, Miss	7	7:38 a. m.	11:00 a. m.	1.02	10:11 a. m.	10:30 a. m.	0.32	0.05	0.38	0.60	0.64	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	16	3:26 p. m.	6:10 p. m.	0.95	3:34 p. m.	3:54 p. m.	0.01	0.20	0.38	0.49	0.54	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Milwaukee, Wis	8–9	.....	.....	0.51	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.27	.....	.....	.....
Montgomery, Ala	30	6:28 p. m.	8:35 p. m.	0.84	6:28 p. m.	6:43 p. m.	0.00	0.34	0.59	0.71	0.73	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Nantucket, Mass	9	.....	.....	0.61	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.32	.....	.....	.....
Nashville, Tenn	29	.....	.....	0.61	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.25	.....	.....	.....
New Haven, Conn	30–31	5:45 p. m.	5:30 a. m.	1.36	6:38 p. m.	7:03 p. m.	0.08	0.29	0.60	0.66	0.70	0.80	.....	.....	.....	.....	.....	.....	.....	.....	.....
New Orleans, La	1	3:40 p. m.	4:43 p. m.	0.74	4:18 p. m.	4:38 p. m.	0.01	0.30	0.52	0.64	0.72	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	6–7	10:55 p. m.	5:10 a. m.	1.95	2:14 a. m.	3:34 a. m.	0.13	0.06	0.11	0.15	0.23	0.34	0.51	0.58	0.60	0.70	0.85	1.20	1.52	.....	.....
New York, N. Y	30	.....	.....	0.43	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.42	.....	.....	.....
Norfolk, Va	15	.....	.....	0.54	.....	.....	.....	.....	.....	.....	0.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Northfield, Vt	25	.....	.....	0.25	.....	.....	.....	.....	0.24	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
North Head, Wash	17	.....	.....	0.22	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.12	.....	.....	.....
Oklahoma, Okla	15–16	8:30 p. m.	D. N.	1.00	10:03 p. m.	10:18 p. m.	0.01	0.30	0.57	0.70	0.73	0.76	0.78	.....	.....	.....	.....	.....	.....	.....	.....
Omaha, Nebr	25	12:00 m...	7:40 p. m.	1.54	3:30 p. m.	4:20 p. m.	0.53	0.09	0.33	0.45	0.52	0.56	0.59	0.62	0.64	0.69	0.72	.....	.....	.....	.....
Palestine, Tex	3–4	6:38 p. m.	D. N.	1.76	7:24 p. m.	7:45 p. m.	0.07	0.20	0.47	0.67	0.77	0.81	0.85	0.88	.....	.....	.....	.....	.....	.....	.....
Parkersburg, W. Va	30	3:40 p. m.	4:45 p. m.	0.56	3:58 p. m.	4:13 p. m.	0.04	0.08	0.37	0.49	0.51	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pensacola, Fla	16	.....	.....	0.53	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.32	.....	.....	.....
Philadelphia, Pa	30–31	.....	.....	0.70	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.43	.....	.....	.....
Pittsburg, Pa	30	.....	.....	0.62	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.53	.....	.....	.....
Pocatello, Idaho	20	.....	.....	0.09	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.08	.....	.....	.....
Portland, Me	9–10	.....	.....	1.49	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.51	.....	.....	.....
Portland, Oreg	18	.....	.....	0.10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.09	.....	.....	.....
Pueblo, Colo	20	.....	.....	0.42	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.37	.....	.....	.....	.....	.....
Raleigh, N. C	31	.....	.....	0.38	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.38	.....	.....	.....
Richmond, Va	9–10	.....	.....	0.83	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.26	.....	.....	.....
Rochester, N. Y	14–15	.....	.....	1.53	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.29	.....	.....	.....
Sacramento, Cal	1	.....	.....	0.03	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.02	.....	.....	.....

TABLE V.—*Accumulated amounts of precipitation for each 5 minutes, etc.*—Continued.

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
St. Louis, Mo	30			0.53														0.44			
St. Paul, Minn	5			1.14														0.67			
Salt Lake City, Utah	3			0.66														0.40			
San Antonio, Tex	6	5:00 a. m.	6:45 a. m.	0.81	5:09 a. m.	5:30 a. m.	0.02	0.18	0.39	0.51	0.58	0.59	0.62	0.68	0.71						
Do	27	5:46 p. m.	8:20 p. m.	2.85	5:50 p. m.	7:20 p. m.	0.02	0.08	0.17	0.25	0.38	0.48	0.55	0.74	0.93	1.17	1.44	1.72	2.47	2.79	
San Diego, Cal	25–26			0.08														0.02			
Sandusky, Ohio	31			1.01														0.34			
San Francisco, Cal	1			0.08														0.07			
Savannah, Ga	2			0.47														0.26			
Scranton, Pa	14–15			0.71														0.27			
Seattle, Wash	5			0.14														0.06			
Shreveport, La	6–7			1.43														0.68			
Spokane, Wash	9–10			0.05														0.04			
Springfield, Ill	26			0.52														0.37			
Springfield, Mo	29			0.70														0.23			
Syracuse, N. Y	19			0.54														0.33			
Tampa, Fla	5	5:25 p. m.	6:35 p. m.	1.38	5:33 p. m.	6:10 p. m.	0.01	0.16	0.43	0.69	0.86	1.07	1.17	1.30	1.35						
Taylor, Tex	3	1:15 p. m.	8:55 p. m.	4.72	3:55 p. m.	5:10 p. m.	1.00	0.13	0.26	0.40	0.45	0.66	1.11	1.66	1.88	2.13	2.25	2.80	3.27		
Do	5–6	D. N.	7:10 a. m.	1.94	4:25 a. m.	5:25 a. m.	0.08	0.10	0.22	0.27	0.31	0.47	0.80	0.95	1.12	1.23	1.35	1.49			
Toledo, Ohio	30			1.15														0.28			
Topeka, Kans	27–28			2.51														0.73			
Valentine, Nebr	12–13			0.66														*			
Vicksburg, Miss	27	7:46 p. m.	9:45 p. m.	1.54	8:39 p. m.	9:25 p. m.	0.13	0.27	0.59	0.81	0.91	0.95	1.00	1.15	1.26	1.34	1.38				
Washington, D. C	9			0.56														0.46			
Wichita, Kans	†	9:53 p. m.	5:40 a. m.	1.12	11:09 p. m.	11:39 p. m.	0.22	0.05	0.17	0.26	0.43	0.58	0.65	0.68							
Wilmington, N. C	17			1.05														0.61			
Wytheville, Va	14			0.42														0.35			
Yankton, S. Dak	15–16			0.75														0.28			
Havana, Cuba	5	2:45 p. m.	5:00 p. m.	1.18	3:01 p. m.	3:48 p. m.	0.02	0.13	0.25	0.36	0.45	0.59	0.79	0.83	0.88	0.94	0.96				
Do	6	12:40 p. m.	3:00 p. m.	1.57	12:47 p. m.	2:10 p. m.	0.04	0.24	0.43	0.49	0.55	0.59	0.62	0.69	0.71	0.75	0.80	0.97	1.31	1.39	1.53
Do	9	1:00 p. m.	3:15 p. m.	0.67	1:50 p. m.	2:15 p. m.	0.04	0.09	0.29	0.41	0.51	0.56	0.60								
Do	17–18	10:50 p. m.	6:30 p. m.	4.51	4:55 a. m.	6:00 a. m.	0.42	0.11	0.30	0.47	0.51	0.54	0.58	0.62	0.68	0.75	0.77	0.90			
Do	19	12:45 p. m.	5:15 p. m.	1.71	1:40 p. m.	2:10 p. m.	0.38	0.13	0.31	0.44	0.54	0.66	0.81	0.85							
San Juan, Porto Rico	18	9:10 a. m.	2:45 p. m.	3.14	12:50 p. m.	1:40 p. m.	1.30	0.18	0.49	0.76	0.89	0.90	0.91	1.08	1.19	1.48	1.62				

* Self register not working. † May 31 to June 1. ‡ Estimated.

TABLE VI.—*Data furnished by the Canadian Meteorological Service, May, 1904.*

Stations.	Pressure, in inches. Actual, reduced to mean of 24 hours.	Pressure, in inches. Sea level, reduced to mean of 24 hours.	Pressure, in inches. Departure from normal.	Temperature. Mean.	Temperature. Departure from normal.	Temperature. Mean maximum.	Temperature. Mean minimum.	Precipitation. Total.	Precipitation. Departure from normal.	Precipitation. Depth of snow.
	Ins.	*Ins.*	*Ins.*	°	°	°	°	*Ins.*	*Ins.*	*Ins.*
St. Johns, N. F	29.81	29.95	—.03	42.8	— 0.1	52.0	33.6	1.84	—1.82	0.3
Sydney, C. B. I	30.01	30.05	+.08	48.3	+ 3.1	59.7	36.8	2.16	—1.61	
Halifax, N. S	29.94	30.05	+.07	51.0	+ 2.6	62.1	39.9	3.32	—0.94	
Grand Manan, N. B	29.91	29.96	—.01	50.4	+ 2.5	57.3	43.4	5.46	+1.85	
Yarmouth, N. S	29.94	30.01	+.03	51.2	+ 3.6	59.3	43.1	3.96	+0.16	
Charlottetown, P. E. I	29.97	30.01	+.05	50.7	+ 3.8	60.6	40.8	1.78	—1.13	
Chatham, N. B	29.92	29.94	—.01	52.2	+ 3.7	63.9	40.4	4.32	+1.11	
Father Point, Que	29.91	29.93	.00	45.8	+ 1.8	53.8	37.7	6.71	+4.13	
Quebec, Que	29.61	29.93	—.01	54.6	+ 4.7	64.1	45.2	3.15	+0.07	
Montreal, Que	29.72	29.92	—.02	59.9	+ 5.2	69.1	50.6	4.76	+1.81	
Bissett, Ont	29.31	29.91	—.02	55.3	+ 3.0	69.8	40.8	3.13	+0.62	0.2
Kingston, Ont	29.57	29.88	—.06	59.9	+ 5.0	70.6	49.1	3.16	+0.57	
Toronto, Ont	29.64	29.95	—.01	54.6	+ 1.7	63.5	45.7	1.92	—0.76	
White River, Ont	29.58	29.95	—.03	55.7	+ 2.5	65.8	45.6	3.52	+0.48	
Port Stanley, Ont	28.65	29.97	+.02	47.8	+ 2.1	61.8	33.8	2.85	+0.90	8.0
Saugeen, Ont	29.31	29.95	—.02	54.0	+ 0.9	62.8	45.3	2.87	—0.31	
	29.24	29.95	—.01	54.0	+ 3.3	64.9	43.1	2.53	+0.09	T.

Stations.	Pressure, in inches. Actual, reduced to mean of 24 hours.	Pressure, in inches. Sea level, reduced to mean of 24 hours.	Pressure, in inches. Departure from normal.	Temperature. Mean.	Temperature. Departure from normal.	Temperature. Mean maximum.	Temperature. Mean minimum.	Precipitation. Total.	Precipitation. Departure from normal.	Precipitation. Depth of snow.
	Ins.	*Ins.*	*Ins.*	°	°	°	°	*Ins.*	*Ins.*	*Ins.*
Parry Sound, Ont	29.20	29.94	—.01	54.0	+ 2.9	65.4	42.5	5.45	+2.52	T.
Port Arthur, Ont	29.23	29.94	—.02	47.4	+ 1.5	57.1	37.7	2.37	+0.22	
Winnipeg, Man	29.11	29.94	—.02	53.5	+ 1.9	67.3	39.7	1.77	—0.51	
Minnedosa, Man	28.14	29.93	—.02	52.9	+ 4.5	66.0	39.7	0.93	—0.52	
Qu'Appelle, Assin	27.66	29.89	—.05	51.6	+ 1.8	62.5	40.6	2.22	+0.57	0.6
Medicine Hat, Assin	27.62	29.89	.00	55.0	+ 0.9	67.9	42.0	1.10	—0.21	
Swift Current, Assin	27.36	29.92	.00	51.7	+ 1.0	63.9	39.4	1.16	—0.60	
Calgary, Alberta	26.37	29.90	+.02	48.0	— 1.0	61.1	34.9	1.56	—0.21	0.2
Banff, Alberta	25.36	29.95	+.07	44.5	— 2.5	56.7	32.3	0.97	—1.07	2.1
Edmonton, Alberta	27.61	29.89	+.01	50.4	— 0.4	63.2	37.6	0.70	—0.85	T.
Prince Albert, Sask	28.33	29.88	—.07	49.8	+ 2.2	61.2	38.3	2.77	+1.51	
Battleford, Sask	28.19	29.92	.00	51.3	+ 0.3	63.9	38.6	1.49	—0.13	
Kamloops, B. C										
Victoria, B. C	29.99	30.09	+.09	52.9	+ 0.4	59.7	46.0	0.49	—0.99	
Barkerville, B. C	25.67	29.99	+.15	40.6	— 4.9	52.6	28.7	1.59	—0.93	8.0
Hamilton, Bermuda	29.90	30.06	.00	70.3	+ 0.9	75.3	65.2	9.09	+4.43	
Dawson, Yukon										

TABLE VII.—*Heights of rivers referred to zeros of gages, May, 1904.*

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water. Height.	Highest water. Date.	Lowest water. Height.	Lowest water. Date.	Mean stage.	Monthly range.
Mississippi River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
St. Paul, Minn	1,954	14	8.3	1	5.8	31	6.9	2.5
Red Wing, Minn	1,914	14	6.2	1	4.0	25	5.1	2.2
Reeds Landing, Minn	1,884	12	7.0	1,2	5.2	23	6.3	1.8
La Crosse, Wis	1,819	12	8.6	1,2	7.1	24,25,27,28	7.9	1.5
Prairie du Chien, Wis	1,759	18	10.4	6,7	8.3	29,30	9.4	2.1
Dubuque, Iowa	1,699	18	11.0	7–9	9.0	31	10.2	2.0
Leclaire, Iowa	1,609	10	6.7	1,9–11	5.8	31	6.3	0.9
Davenport, Iowa	1,593	15	9.1	9–11	7.7	31	8.5	1.4
Muscatine, Iowa	1,562	16	10.8	1	9.1	30,31	9.9	1.7
Galland, Iowa	1,472	8	6.3	1	4.3	29	5.1	2.0
Keokuk, Iowa	1,463	15	12.1	1	7.8	28,29	9.0	4.3
Hannibal, Mo	1,402	13	15.3	1	9.1	29	10.8	6.2
Grafton, Ill	1,306	23	23.9	1	12.0	28,29	16.1	11.9
St. Louis, Mo	1,264	30	33.2	1	18.5	27	24.0	14.7
Chester, Ill	1,189	30	30.4	1	15.8	28	21.3	14.6
New Madrid, Mo	1,003	34	33.5	6,7	18.3	29	26.1	15.2
Memphis, Tenn	843	33	32.2	8–10	15.4	30,31	25.1	16.8
Mississippi River—Cont'd.								
Helena, Ark	767	42	42.0	11	22.6	31	35.0	19.4
Arkansas City, Ark	635	42	44.9	1	29.3	31	41.1	15.6
Greenville, Miss	595	42	39.7	1	24.6	31	35.6	15.1
Vicksburg, Miss	474	45	45.4	1	31.7	31	41.7	13.7
Natchez, Miss	373	46	45.2	1	35.1	31	42.3	10.1
Baton Rouge, La	240	35	33.7	2	27.5	31	31.8	6.2
Donaldsonville, La	188	28	27.1	2	21.7	31	25.4	5.4
New Orleans, La	108	16	17.6	2	14.1	31	16.3	3.5
Yellowstone River.								
Glendive, Mont	98	17	9.3	27	3.4	1	5.4	5.9
James River.								
Lamoure, N. Dak		25	4.0	1	— 0.4	30,31	0.8	4.4
Huron, S. Dak	210	25	5.1	31	3.6	1,2,11	4.3	1.5
Missouri River.								
Townsend, Mont	2,504	10	8.3	25,26	5.8	10,11,14	6.6	2.5
Fort Benton, Mont	2,285	12	5.4	25,27–29	3.5	16,17	4.2	1.9
Bismarck, N. Dak	1,309	14	8.1	30	3.6	5,6	5.1	4.5

TABLE VII.—*Heights of rivers referred to zeros of gages*—Continued.

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Missouri River—Cont'd.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Pierre, S. Dak.	1,114	19	9.0	31	5.8	23	6.6	3.2
Sioux City, Iowa	784	18	9.7	19	8.6	27, 28	9.1	1.1
Omaha, Nebr.	669	10	10.3	1, 29	9.6	5, 15	9.9	0.7
Plattsmouth, Nebr	641	17	6.5	20	5.1	4, 5	5.8	1.4
St. Joseph, Mo	481	10	7.4	1	5.4	6	5.9	2.0
Kansas City, Mo.	388	21	19.4	31	12.7	26	15.1	6.7
Glasgow, Mo	231	.....	14.7	1	7.7	28	10.3	7.0
Boonville, Mo.	199	20	18.1	1	11.6	28	13.8	6.5
Hermann, Mo.	103	24	21.1	1	13.0	26	15.7	8.1
Des Moines River.								
Des Moines, Iowa	205	19	6.3	1, 29, 30	3.8	25	4.8	2.5
Illinois River.								
Peoria, Ill.	135	14	16.2	1	11.7	30, 31	13.6	4.5
Allegheny River.								
Warren, Pa.	177	14	6.9	19	1.5	17, 18	3.4	5.4
Oil City, Pa	123	13	7.4	20	1.9	15	3.8	5.5
Parker, Pa.	73	20	8.0	20	2.0	13, 14	4.2	6.0
Freeport, Pa	29	20	11.3	29	4.3	14	7.3	7.0
Red Bank Creek.								
Brookville, Pa.	35	8	2.5	19	0.6	13-18, 28-30	0.9	1.9
Clarion River.								
Clarion, Pa.	32	10	7.0	19	1.5	14	3.2	5.5
Conemaugh River.								
Johnstown, Pa.	64	7	5.0	19	1.6	17, 18	2.6	3.4
Cheat River.								
Rowlesburg, W. Va	86	14	6.0	21	2.6	15, 31	3.4	3.4
Youghiogheny River.								
Confluence, Pa.	59	23	3.8	19	1.0	16–18	2.2	2.8
West Newton, Pa	15	10	6.0	20	1.1	14	2.6	4.9
Monongahela River.								
Weston, W. Va.	161	18	0.4	1, 2	— 0.3	11–14, 19	0.0	0.7
Fairmont, W. Va.	119	25	17.9	1	14.7	13, 14	15.6	3.2
Greensboro, Pa.	81	18	11.8	1	7.3	14, 15	8.6	4.5
Lock No. 4, Pa.	40	28	14.2	1	6.9	14, 16	9.0	7.3
Ohio River.								
Pittsburg, Pa	966	22	11.2	1	3.2	11	6.6	8.0
Davis Island Dam, Pa.	960	25	11.8	1	4.7	14	7.8	7.1
Reaver Dam, Pa	935	27	17.5	1	6.0	13, 15	10.5	11.5
Wheeling, W. Va.	875	36	18.2	1	5.6	15	10.4	12.6
Parkersburg, W. Va.	785	36	23.4	1	6.5	16	10.9	16.9
Point Pleasant, W. Va.	703	39	26.2	1	5.3	18	12.9	20.9
Huntington, W. Va.	660	50	30.9	1	8.8	18	16.9	22.1
Catlettsburg, Ky.	651	50	31.9	1	7.7	18	16.6	24.2
Portsmouth, Ohio	612	50	32.5	1	9.0	19	17.5	23.5
Cincinnati, Ohio.	499	50	32.9	2	10.7	20	20.1	23.2
Madison, Ind	413	46	28.5	3	9.8	20	16.6	18.7
Louisville, Ky.	367	28	10.9	3	5.0	22	7.7	5.9
Evansville, Ind.	184	35	25.1	5, 6	8.0	24	15.4	17.1
Paducah, Ky.	47	40	28.4	6, 7	9.7	28	18.7	18.7
Cairo, Ill.	1	45	42.0	6	22.1	28	31.8	19.9
Beaver River.								
Ellwood Junction, Pa.	10	14	5.8	28	2.2	22, 25	3.3	3.6
Muskingum River.								
Zanesville, Ohio	70	20	13.5	1	8.5	15, 16, 20-25	9.6	5.0
Little Kanawha River.								
Glenville, W. Va[1]	103	20	.....	.....	.....	.....	.....	.....
New River.								
Radford, Va	155	14	5.0	19	0.8	8	1.8	4.2
Hinton, W. Va.	95	14	5.9	20	2.0	31	2.9	3.9
Great Kanawha, River.								
Charleston, W. Va.	58	30	9.7	22	4.4	10	6.7	5.3
Scioto River.								
Columbus, Ohio.	110	17	5.6	1	2.7	13-21, 30, 31	3.2	2.9
Licking River.								
Falmouth, Ky.	30	25	4.5	1–3	1.7	26–29	3.2	2.8
Miami River.								
Dayton, Ohio	77	18	2.1	1	1.4	13-17, 26, 27	1.6	0.7
Kentucky River.								
Beattyville, Ky	254	30	3.5	1	1.0	25–30	1.7	2.5
High Bridge, Ky.	117	17	12.9	1	9.7	29, 30	10.6	3.2
Frankfort, Ky.	65	31	8.8	1	6.4	27–30	7.0	2.4
Wabash River.								
Mount Carmel, Ill.	50	15	14.7	2	4.8	23–25	7.1	9.9
Clinch River.								
Speers Ferry, Va.	156	20	2.5	1	— 0.2	28	0.6	2.7
Clinton, Tenn.	52	25	10.0	1	3.5	30	5.8	6.5
Holston River.								
Bluff City, Tenn.	170	15	3.6	4	0.8	26–31	1.5	2.2
Rogersville, Tenn.	103	14	4.3	5	1.8	29–31	2.6	2.5
French Broad River.								
Asheville, N. C.	144	6	2.2	9	— 0.4	29, 30	0.0	2.6
Leadvale, Tenn.	70	15	2.8	10	— 1.0	26, 27	0.1	3.8
Hiwassee River.								
Charleston, Tenn	18	22	4.8	9	1.1	26, 29, 30	1.8	3.7
Tennessee River.								
Knoxville, Tenn.	635	29	5.0	10	1.0	29–31	2.5	4.0
Kingston, Tenn	556	25	5.5	1	1.8	30	3.2	3.7
Chattanooga, Tenn.	452	33	7.6	2	2.6	30	4.8	5.0
Bridgeport, Ala.	402	24	5.3	3	1.4	29	3.3	3.9
Florence, Ala.	255	16	4.6	14	1.2	29	2.9	3.4
Riverton, Ala.	225	25	5.5	5, 14, 15	1.1	29, 31	3.4	4.4
Johnsonville, Tenn.	95	21	6.5	7, 16	2.9	30	4.9	3.6
Cumberland River.								
Burnside, Ky.	518	50	7.4	1	1.9	29	4.5	5.5
Celina, Tenn.	383	45	11.8	4	3.2	29–30	7.4	8.6
Carthage, Tenn.	308	40	9.1	5	2.8	28–30	5.7	6.3
Nashville, Tenn	193	40	12.4	6	4.2	29, 30	8.4	8.2
Clarksville, Tenn.	126	42	15.0	7	6.3	31	11.3	8.7
Arkansas River.								
Wichita, Kans.	832	10	2.4	30	0.2	1, 2	0.9	2.2
Webbers Falls, Ind. T.	465	23	12.6	1	5.3	6	8.2	7.3
Fort Smith, Ark.	403	22	12.9	2	5.5	28	8.7	7.4
Dardanelle, Ark	256	21	12.5	3	5.6	29, 30	8.6	6.9
Little Rock, Ark.	176	23	13.4	4	6.5	30, 31	9.8	6.9

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
White River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Newport, Ark.	150	26	17.0	1	4.1	31	10.5	12.9
Yazoo River.								
Yazoo City, Miss.	80	25	22.3	1	7.0	31	17.0	15.3
Ouachita River.								
Camden, Ark.	304	39	22.3	1, 11	6.0	31	12.2	16.3
Monroe, La.	122	40	27.3	1	14.8	31	23.8	12.5
Red River.								
Arthur City, Tex.	688	27	14.2	8	5.4	5, 6	8.1	8.8
Fulton, Ark.	515	28	18.0	11	7.4	31	11.2	10.6
Shreveport, La.	327	29	11.0	1	4.6	31	7.6	6.4
Alexandria, La.	118	33	14.4	4	6.3	31	11.1	8.1
Atchafalaya River.								
Melville, La.	100	31	34.3	2–4	31.4	31	33.5	2.9
Mohawk River.								
Utica, N. Y.[3]	98	.....	.....	.....	.....	.....	.....	.....
Tribeshill, N. Y.	42	.....	3.0	1	— 1.4	14	0.0	4.4
Schenectady, N. Y.	19	.....	6.8	1	1.5	15	2.9	5.3
Hudson River.								
Glens Falls, N. Y.	197	.....	12.1	1	6.5	31	8.4	5.6
Mechanicsville[1]	.....	.....	.....	.....	.....	.....	.....	.....
Troy, N. Y.	154	.....	13.7	1	5.4	31	7.6	8.3
Albany, N. Y.	147	.....	9.8	1	3.4	25	5.6	6.4
Stuyvesant, N. Y[1]	128	.....	.....	.....	.....	.....	.....	.....
Passaic River.								
Chatham, N. J.	69	.....	3.5	2	2.3	27–30	2.7	1.2
Pompton River.								
Pompton Plains, N. J.[2]	6	.....	4.4	18, 20, 31	4.2	{22–25, 29, 30}	.....	0.2
East Branch Susquehanna.								
Binghamton, N. Y	306	16	5.1	1	2.4	29–31	3.1	2.7
Towanda, Pa.	262	16	6.3	20	1.7	14	3.2	4.6
Wilkesbarre, Pa.	183	17	11.5	1	4.8	14, 15	7.1	6.7
West Branch Susquehanna.								
Lockhaven, Pa.	65	12	3.5	20	— 0.3	13–15, 19	1.1	3.8
Williamsport, Pa.	39	20	7.8	1	2.5	14	4.4	5.3
Susquehanna River.								
Selinsgrove, Pa.	116	17	6.2	21	1.7	14	3.2	4.5
Harrisburg, Pa.	69	17	8.2	1	3.2	14	4.9	5.0
Juniata River.								
Huntingdon, Pa.	90	24	7.1	19	3.7	{12–14, 17, 18, 30}	4.2	3.4
Potomac River.								
Cumberland, Md.	290	8	6.4	12, 13	4.4	27, 28	5.4	2.0
Harpers Ferry, W. Va.	172	18	7.5	1	1.5	19, 31	3.1	6.0
Shenandoah River.								
Riverton, Va.	58	22	4.0	1	0.5	12–31	0.7	3.5
James River.								
Lynchburg, Va.	260	18	6.9	19	2.0	{5–7, 12–15, 30, 31}	2.7	4.9
Richmond, Va.	111	12	4.8	21	— 0.7	15	1.0	5.5
Dan River.								
Danville, Va.	55	8	1.7	19	— 0.2	7, 29, 30	0.1	1.9
Roanoke River.								
Clarksville, Va	196	12	8.8	19	3.2	30	4.5	5.6
Weldon, N. C.	129	30	15.6	20	9.0	30	10.1	6.6
Cape Fear River.								
Fayetteville, N. C.	112	38	8.2	20	2.3	31	4.8	5.9
Waccamaw River.								
Conway, S. C.	40	7	2.8	3–5	1.6	{12–15, 27, 28}	2.2	1.2
Pedee River.								
Cheraw, S. C.	149	27	8.1	21	1.5	31	2.7	6.6
Smiths Mills, S. C.	51	16	7.8	24	1.8	31	4.2	6.0
Lynch Creek.								
Effingham, S. C.	35	12	4.5	24, 25	3.6	31	4.1	0.9
Black River.								
Kingstree, S. C.	52	12	3.4	10–13	1.1	29, 30	2.5	2.3
Wateree River.								
Camden, S. C.	45	24	11.9	12	5.5	31	6.8	6.4
Congaree River.								
Columbia, S. C.	37	15	— 0.2	1–3	— 1.4	26–31	— 0.9	1.2
Santee River.								
St. Stephens, S. C.	50	12	4.8	15	0.0	31	2.3	4.8
Savannah River.								
Calhoun Falls, S. C.	347	15	3.4	9	1.7	29	2.2	1.7
Augusta, Ga.	268	32	9.3	11	5.8	28–31	6.9	3.5
Broad River.								
Carlton, Ga.	30	11	3.5	9	1.8	25–29	2.2	1.7
Oconee River.								
Dublin, Ga	79	30	1.0	1–3, 13–15	— 1.5	30	0.3	2.5
Ocmulgee River.								
Macon, Ga.	203	18	5.3	10	1.3	29, 30	2.4	4.0
Abbeville, Ga.	96	11	4.2	13	0.9	30, 31	2.1	3.2
Flint River.								
Woodbury, Ga.	.....	.....	1.0	31	0.0	22–30	0.2	1.0
Albany, Ga.	80	20	2.5	6	0.5	29	1.5	2.0
Chattahoochee River.								
Oakdale, Ga	305	18	4.5	10	0.8	26–29	1.6	3.7
West Point, Ga	239	20	3.4	11	1.8	27–30	2.3	1.6
Coosa River.								
Rome, Ga.	271	30	3.8	10	0.7	30, 31	1.9	3.1
Gadsden, Ga.	144	22	2.0	12	— 0.2	25–29	0.6	2.2
Lock No. 4, Ala.	116	17	2.0	12	0.2	29, 30	1.0	1.8
Wetumpka, Ala	6	45	4.2	1	1.0	30	2.5	3.2
Alabama River.								
Montgomery, Ala.	265	35	2.3	1, 2	— 0.1	30	1.0	2.4
Selma, Ala	212	35	2.1	2, 3	— 0.5	29, 30	0.9	2.6
Tombigbee River.								
Columbus, Miss	308	33	— 1.3	1, 3	— 2.5	25–30	— 2.0	1.2
Demopolis, Ala.	155	35	2.4	1	— 1.9	31	— 0.2	4.3
Black Warrior River.								
Tuscaloosa, Ala.	90	43	6.8	1	4.8	29, 30	5.5	2.0
Sabine River.								
Logansport, La.	180	25	13.4	22	3.0	31	9.1	10.4
Orange, Tex.	10	7	1.8	16-20	1.0	1–14	1.3	0.8

TABLE VII.—*Heights of rivers referred to zeros of gages.*—Continued.

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Neches River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet*	*Feet.*
Rockland, Tex	110	20	14.5	9, 10	2.2	31	8.2	12.3
Beaumont, Tex	40	10	3.0	11, 12	0.7	31	1.9	2.3
Trinity River.								
Dallas, Tex	330	25	23.0	5	3.0	17	8.3	20.0
Riverside, Tex	100	40	25.5	9	4.0	27, 31	15.1	21.5
Liberty, Tex	42	25	23.8	12, 13	7.0	31	17.7	16.8
Brazos River.								
Kopperl, Tex	369	21	7.0	6	— 0.4	30, 31	1.4	7.4
Waco, Tex	301	24	11.2	7	2.9	1, 2	4.8	8.3
Hempstead, Tex	215	40	35.3	9	1.8	1	12.9	33.5
Booth, Tex	76	39	30.2	10	2.3	1	12.0	27.9
Colorado River.								
Ballinger, Tex	400	21	6.0	18	1.0	1, 2	2.1	5.0
Colorado River—Cont'd.								
Austin, Tex	214	18	6.5	6	1.6	3	2.9	4.9
Columbus, Tex	100	24	28.0	5	7.1	30	11.6	20.9
Red River of the North.								
Moorhead, Minn.	418	26	12.0	1	9.7	20–24	10.2	2.3
Columbia River								
Umatilla, Oreg.	270	25	21.1	25, 26	16.4	11	18.1	4.7
The Dalles, Oreg.	166	40	36.0	26	27.2	11, 12	30.4	8.8
Willamette River.								
Albany, Oreg.	118	20	8.0	1	4.8	30, 31	5.9	3.2
Portland, Oreg.	12	15	20.8	27, 28	16.3	12, 13	17.9	4.5
Sacramento River.								
Red Bluff, Cal.	265	23	10.2	1	5.5	31	7.5	4.7
Sacramento, Cal.	64	25	22.2	15	20.5	31	21.3	1.7

[1] No record. [2] 14 days only. [3] Record incomplete.

HAWAIIAN CLIMATOLOGICAL DATA.

By R. C. LYDECKER, Territorial Meteorologist.

Rainfall data for May, 1904.

Stations.	Elevation.	Amount.
HAWAII.		
HILO, e. and ne.	*Feet.*	*Inches.*
Waiakea	50	7.80
Hilo (town)		
Puueo	85	7.58
Kaumana	1,250	11.72
Pepeekeo	100	7.15
Hakalau	200	9.29
Honohina	300	8.28
Puuohua	1,050	11.61
Laupahoehoe	500	9.15
Ookala	400	6.55
HAMAKUA, ne.		
Kukaiau	250	5.70
Pasuilo	300	4.49
Paauhau	300	3.35
Honokaa (Mill)	425	4.30
Honokaa (Meinicke)	1,100	3.29
Kukuihaele	700	3.28
KOHALA, n.		
Awini Ranch	1,100	5.80
Niulii	450	3.77
Halawa	200	3.74
Kohala (Mission)	521	3.25
Kohala (Sugar Co.)	270	3.65
Hawi Mill	700	3.24
Puukea Ranch	600	2.29
Puuhue Ranch	1,847	1.74
Waimea	2,720	2.51
KONA, w.		
Huehue	2,000	6.77
Holualoa	1,350	8.50
Kaukahoku Leheula	3,500	
Kainaliu	1,470	
Kealakekua	1,580	8.12
Napoopoo	25	5.79
Hoopuloa	1,650	4.61
Hoopuloa	2,300	5.07
Puuwaawaa Ranch	2,700	2.64
Huehue		
KAU, se.		
Kahuku Ranch	2,000	6.83
Honuapo	15	0.87
Naalehu	650	2.93
Hilea	310	0.70
Pahala	850	2.79
Volcano House	4,000	6.96
PUNA, e.		
Olaa, Mountain View (Russel)	1,530	15.21
Olaa Plantation (Mill)	210	9.78
Olaa (20 miles)	1,700	18.88
Kapoho	110	7.27
Pahoa	600	9.72
MAUI.		
Lahaina		
Waiopae Ranch	700	
Kaupo (Mokulau), s.	285	4.55
Kipahulu, s	308	3.83
Hana		
Nahiku, ne	850	5.87
Nahiku	700	
Haiku, n	700	2.00
Kula (Erehwon), n	4,500	2.16
Kula (Waiakoa), n	2,700	1.02
Puuomalei, n	1,400	1.61
MAUI—*Cont'd.*	*Feet.*	*Inches.*
Wailuku, ne	180	0.26
Paia	2,000	
Haleakala Ranch	250	
LANAI.		
Keomuku	10	0.00
OAHU.		
Punahou (W. B.), sw.	47	1.33
Kulaokahua (Castle), sw.	50	0.73
Makiki Reservoir	120	
U. S. Naval Station, sw.	6	0.66
Kapiolani Park, sw.	10	
College Hills	175	2.02
Manoa (Woodlawn Dairy), e.	285	5.74
Manoa (Rhodes Gardens)	360	6.72
Insane Asylum	30	1.45
School street (Bishop), sw.		
Kamehameha School		
Kalihi-Uka, sw	485	5.45
Nuuanu (W. W. Hall), sw.	50	
Nuuanu (Wyllie street)	250	2.11
Nuuanu (Elec. Station), sw.	405	3.59
Nuuanu (Luakaha), e.	850	7.04
U. S. Experiment Station	350	2.20
Kaliula	1,150	
Laniakea (Nahuina)		
Tantalus Heights (Frear)	1,360	5.73
Waimanalo, ne	25	0.44
Maunawili, ne	300	2.30
Kaneohe	100	1.04
Ahuimanu, ne	350	2.23
Kahuku, n	25	0.72
Waialua		
Wahiawa	900	1.46
Ewa Plantation, s	60	0.09
U. S. Magnetic Station	45	
Waipahu	200	0.00
Moanalua	15	0.78
Pacific Heights		
KAUAI.		
Lihue (Grove Farm), e.	200	1.13
Lihue (Molokoa), e.	300	1.39
Lihue (Kukaua), e.	1,000	2.57
Lihue (Kilohana)	400	1.51
Kealia, e.	15	0.53
Kilauea (Plantation), ne.	325	1.99
Hanalei, n	10	
Waioli		
Haena		
Waiawa	32	0.05
Elecele	150	1.20
Wahiawa (Mountain)	3,000	
McBryde (Residence)	850	1.98
Lawai (Gov. Road)	450	3.50
Lawai, w	225	
Lawai, e	800	4.31
Koloa	100	1.61
Lawai Beach		1.84
Delayed April reports.		
Pala		3.26
Kipahulu		6.91
Napoopoo		10.50
Insane Asylum		3.44
Kealia		2.62
Elecele		1.48

NOTE.—The letters n, s, e, w, and c show the exposure of the station relative to the winds.

Meteorological Observations at Honolulu, May, 1904.

The station is at 21° 18′ north, 157° 50′ west. It is the Hawaiian Weather Bureau station Punahou. (See fig. 2, No. 1, in the MONTHLY WEATHER REVIEW for July, 1902, page 365.)

Hawaiian standard time is 10h 30m slow of Greenwich time. Honolulu local mean time is 10h 31m slow of Greenwich.

The pressure is corrected for temperature and reduced to sea level, and the gravity correction, —0.06, has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force, or amounts of cloudiness, connected by a dash, indicate change from one to the other.

Rainfall for twenty-four hours is measured at 9 a. m. local, or 7:31 p. m., Greenwich time.

The rain gage, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet and the barometer 50 feet above sea level.

Date.	Pressure at sea level.	Temperature.		During twenty-four hours preceding 1 p. m. Greenwich time, or 2:30 a. m. Honolulu time.								Total rainfall at 9 a. m., local time.
				Temperature.		Means.		Wind.		Average cloudiness.	Sea-level pressures.	
		Dry bulb.	Wet bulb.	Maximum.	Minimum.	Dew-point.	Relative humidity.	Prevailing direction.	Force.		Maximum.	Minimum.	
	*	†	†			‡	‡		§				
1	30.05	72	65.5	78	69	62.3	70	ne.	1–2	7–4	30.11	30.04	0.00
2	30.04	72	66	79	71	63.0	69	ne.	1	2–7	30.10	30.03	0.11
3	30.05	72	65.5	78	70	63.3	69	ne.	1–2	5	30.10	30.03	0.03
4	30.10	71	64.5	78	71	62.5	68	ne.	1–2	4	30.12	30.05	0.03
5	30.10	71	65	79	70	62.0	68	ne.	3	3–1	30.13	30.06	0.22
6	30.08	72	65.5	78	69	62.7	69	ne.	3	4–2	30.13	30.06	0.00
7	30.04	72	65.5	78	72	63.5	71	ne.	1–2	¶	30.13	30.05	0.06
8	30.00	70	66	80	71	63.5	70	ne.	1	1–5	30.07	30.00	0.02
9	29.95	68	64	80	69	64.5	74	ne.	1–0	1–6	30.04	29.96	0.00
10	29.94	65	62	81	66	61.5	70	ne.-nne.	1–0	1	29.99	29.91	0.00
11	29.98	64	62	80	63	61.7	73	sw.-nne.	1–0	0–4	30.00	29.94	0.00
12	29.97	73	65	81	61	62.7	71	ne.	0–1	1	30.02	29.93	0.00
13	30.00	70	65.5	80	72	60.0	61	ne.	2	4	30.04	29.95	0.00
14	29.99	69	66	82	70	63.0	69	ne.	1–0	1	30.04	29.95	0.00
15	30.01	68	66.5	82	67	66.3	81	se.-ne.	1–0	3–9	30.04	29.99	0.30
16	30.03	73	65.5	81	67	64.7	74	ne.	1–0	4	30.06	30.01	0.00
17	30.04	71	64.5	81	71	62.0	65	ne.	1–0	3	30.07	30.00	T.
18	30.04	70	64.5	81	68	62.5	66	ne.	1–0	1	30.07	30.00	0.00
19	30.01	70	65.5	82	66	62.3	68	ne.	0	4	30.07	30.00	0.00
20	29.97	66	63	82	65	61.7	66	ne.	0	1	30.03	29.96	0.00
21	29.93	66	63	81	64	61.3	71	wsw.	1–0	1–5	29.98	29.91	0.00
22	29.92	67	64.5	81	63	62.7	74	‖	1–0	2	29.97	29.90	0.00
23	29.96	66	63.5	81	66	64.0	73	sw.	1–0	0 9–3	29.99	29.92	0.00
24	29.96	69	65	84	65	64.7	74	ne.	1–0	2	29.99	29.94	0.00
25	29.96	74	66.5	83	68	62.5	66	ne.	2–0	1	30.01	29.93	0.00
26	29.98	70	68.5	83	73	61.3	61	ne.	1	2	30.02	29.94	0.23
27	29.99	74	67	81	69	65.3	76	ne.	2–0	4	30.03	29.96	0.05
28	29.98	70	68	81	71	62.7	68	ne.	2–0	4	30.03	29.98	0.09
29	29.98	74	67	81	69	64.5	72	ne.	1–0	6–3	30.04	29.96	0.17
30	29.97	74	65.5	82	69	62.5	63	ne.	1–2	4	30.03	29.98	0.02
31	29.98	72	65	83	73	61.5	64	ne.	1–0	4	30.03	29.96	0.00
Sums													1.33
Means	30.000	70.2	65.2	80.7	68.3	62.9	69.5		0.9	3.1	30.048	29.977	
Departure.	—.020					—1.1	—3.0			—1.4			—1.22

Mean temperature for the month of May, 1904 (9 + 2 + 9), + 3 = 74.1°; normal is 74.1°. Mean pressure for the month of May, 1904, (9 + 3) + 2 = 30.010; normal is 30.030.

* This pressure is as recorded at 1 p. m., Greenwich time. † These temperatures are observed at 6 a. m., local, or 4:31 p. m., Greenwich time. ‡ These values are the means of (6 + 9 + 2 + 9) + 4. § Beaufort scale. ‖ wsw-ssw. ¶ 1-10-2.

Maximum thermometer set at 9 p. m. and minimum at 2 p. m., local time.

GENERAL SUMMARY FOR MAY, 1904.

Honolulu.—Temperature mean for the month, 74.1°; normal, 74.1°; average daily maximum, 80.7°; average daily minimum, 68.3°; mean daily range, 12.4°; greatest daily range, 20° (11th); least daily range, 6° (6th); highest temperature, 84° (23d); lowest temperature, 61° (11th).

Barometer average, 30.010; normal, 30.030; highest, 30.13 (4th, 5th, 6th); lowest, 29.91 (21st); greatest 24-hour change, that is from any given hour of one day to the same hour on the next, .06 (9 a. m. and 9 p. m. 6th to 9 a. m. and 9 p. m. 7th, and 9 p. m. to 9 p. m. 18th to 19th); lows passed this point, 9th to 13th and 20th to 25th, inclusive; highs, 1st to 7th and 16th to 18th, inclusive.

Relative humidity average, 69.5 per cent; normal, 72.5 per cent; mean dew-point, 62.9°; normal, 64.0°; mean absolute moisture, 6.31 grains per cubic foot; normal, 6.53 grains.

Rainfall, 1.33 inches; normal, 2.55 inches; greatest rainfall in twenty-four hours, 0.30 inches (from 9 a. m. 14th to 9 a. m. 15th); rain record days, 12; normal, 19.

The artesian well water level fell from 36.30 to 35.86 feet above mean sea level. May 31, 1903, it stood at 34.65. The average daily mean sea level was 9.70, the assumed annual mean being 10 feet above datum. For May, 1903, it was 9.65.

Trade wind days, 26 (2 nne.); normal, 24; average force of wind, Beaufort scale and during daylight, 0.9; average cloudiness, tenths of sky, 3.1; normal, 4.5.

Approximate percentages of district rainfall as compared with normal: Hawaii, Hilo district, 92 per cent; Hamakua, 105; Kohala, 83; Waimea, 93; Kona, 110; Kau, variable, from 42 per cent at Hilea to 166 at Naalehu; Puna, 125; Island of Maui, 76; Oahu, Honolulu district, 64; Nuuanu, 65; Koolau, 28; Ewa, 9; Island of Kauai, 30 per cent.

The heaviest monthly rainfall was at Olaa (1700 feet elevation), 18.88 inches. The heaviest 24-hour rainfalls were at Olaa (1700), 4.17 inches; Ookala, 3.20, and Puuohua, Hawaii, 2.67; all on the 4th.

Temperature table for May, 1904.

Stations.	Elevation.	Mean max.	Mean min.	Cor. av'ge.	Highest.	Lowest.
	Feet.	°	°	°	°	°
Hilo	50					
Pepeekeo	100	77.2	67.4	71.6	80	63
Olaa Mill	210	84.8	63.3	73.4	87	61
Kohala	521	77.8	66.3	71.4	82	64
Waimea	2,730	70.9	58.0	63.8	76	52
Volcano House	4,000	68.4	51.0	59.0	71	47
Waiakoa	2,700	83.2	56.0	69.0	92	55
Keomuku	10	83.2	73.2	77.9	91	71
Kinau Street (Castle)	50	81.9	68.5	73.9	85	60
United States Magnetic Station	50					
Ewa Mill	60	82.0	64.2	72.4	84	59
United States Experiment Station	350	82.1	67.8	74.2	85	63

Ewa Mill, dew-point, 57.0°; relative humidity, 61.0 per cent; barometer average, 30.00 inches.

Kohala, dew-point, 64.6°; relative humidity, 77.2 per cent.

The precipitation throughout the group with the exception of the Island of Hawaii, was considerably below the normal, and was the lighest May rainfall recorded at the Weather Bureau for eight years. Dew at Honolulu four mornings.

Reported from other stations: Pepeekeo, Hawaii: Snow on mountain tops 12th, and still visible 22d; easterly winds throughout, average force, 1.2; heavy surf 1st to 8th inclusive; dew two mornings. Kohala and Waimea, Hawaii, trade winds all the month.

COSTA RICAN CLIMATOLOGICAL DATA.

Communicated by Mr. H. PITTIER, Director, Physico-Geographic Institute.

TABLE 1.—*Hourly observations at the Observatory, San José de Costa Rica, during May, 1904.*

Hours.	Pressure.		Temperature.		Relative humidity.		Rainfall.		
	Observed, 1904.	Normal, 1889–1903.	Observed, 1904.	Normal, 1889–1903.	Observed, 1904.	Normal, 1889–1903.	Observed, 1904.	Normal, 1889–1903.	Duration, 1904.
	Inches.	*Inches.*	° *F.*	° *F.*	%	%	*Ins.*	*Ins.*	*Hrs.*
1 a. m	26.15	26.14	63.5	64.4	95	91	.....	0.08	.....
2 a. m	26.13	26.13	63.1	64.0	95	91	.....	0.03	.....
3 a. m	26.11	26.11	62.6	63.7	93	91	0.01	0.04	0.58
4 a. m	26.10	26.11	62.5	63.3	93	90	0.01	0.02	1.50
5 a. m	26.10	26.09	62.1	63.0	94	90	0.01	0.02	0.91
6 a. m	26.11	26.12	61.5	62.8	93	90	0.07	0.02	1.00
7 a. m	26.12	26.13	62.1	63.3	92	89	.....	0.01	.....
8 a. m	26.13	26.14	66.2	68.5	79	79	.....	0.02	.....
9 a. m	26.14	26.15	70.2	71.1	73	72	.....	0.02	.....
10 a. m	26.15	26.16	73.8	74.8	68	69	.....	0.01	.....
11 a. m	26.14	26.15	77.0	77.2	61	65	.....	0.02	.....
Noon	26.13	26.14	78.5	78.4	59	62	.....	0.05	.....
1 p. m	26.11	26.12	78.3	78.7	64	61	.....	0.31	.....
2 p. m	26.09	26.11	76.5	77.7	69	64	0.28	0.68	0.92
3 p. m	26.08	26.09	74.3	74.8	73	70	0.88	0.92	2.76
4 p. m	26.08	26.08	71.2	70.9	83	76	1.52	1.64	5.16
5 p. m	26.08	26.09	69.3	70.3	86	80	0.93	1.32	6.82
6 p. m	26.09	26.10	67.3	69.1	91	84	1.77	1.37	9.66
7 p. m	26.11	26.12	66.4	67.6	93	87	1.21	1.09	12.02
8 p. m	26.13	26.13	65.9	66.7	93	89	1.07	0.83	11.68
9 p. m	26.14	26.15	65.5	66.2	94	90	0.56	0.53	9.60
10 p. m	26.15	26.16	65.5	65.1	94	90	0.55	0.24	7.53
11 p. m	26.16	26.16	64.4	64.9	94	91	0.03	0.18	1.84
Midnight	26.15	26.16	64.0	64.9	94	91	0.32	0.11	2.50
Mean	26.12	26.13	67.9	68.9	84	81	.....	.....	.....
Minimum	26.04	25.98	57.6	53.4	38	.....	.....	.....	.....
Maximum	26.22	26.24	85.1	90.5	100	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	9.22	9.56	73.48

REMARKS.—At San José the barometer is 3,835 feet above sea level. Readings are corrected for gravity, temperature, and instrumental error. The hourly readings for pressure, and wet and dry bulb thermometers, are obtained by means of Richard registering instruments, checked by direct observations every three hours from 7 a. m. to 10 p. m. The thermometers are 5 feet above ground and are corrected for instrumental errors. The total hourly rainfall is as given by Hottinger's self-register, checked once a day. Under maximum, the greatest hourly rainfall for the month is given. The standard rain gage is 5 feet above ground. Since January 1, 1902, observations at San José have been made on seventy-fifth meridian time, which is 0 hours, 36 minutes, 13.3 seconds *in advance* of San José local time. The normals for pressure, temperature, and relative humidity have been adjusted to this time; the normal for rainfall in Table 1 and the sunshine observations and normal in Table 2 refer to local time. At Port Limon the hours of direct observation are 8 a. m., 2 and 8 p. m., San José local time; the barometer is 14 feet above sea level. The means for temperature and relative humidity in Table 4 are obtained from two-hourly readings given by a Richard self-registering thermometer.

TABLE 2.—*San José, May, 1904.*

Time.	Sunshine.		Cloudiness.		Temperature of the soil at depth of—				
	Observed, 1904.	Normal, 1889–1903.	Observed, 1904.	Normal, 1889–1903.	6 inches.	12 inches.	24 inches.	48 inches.	120 inches.
	Hours.	*Hours.*	%	%	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*
7 a. m	18.82	12.99	47	58	71.2	72.0	72.0	71.4	70.7
8 a. m	21.61	20.28	.....	.....	.....	.....	.....	.....	.....
9 a. m	21.74	21.82	.....	.....	.....	.....	.....	.....	.....
10 a. m	26.07	22.18	58	63	71.4	71.8	72.7	71.6	.....
11 a. m	24.46	20.85	.....	.....	.....	.....	.....	.....	.....
Noon	22.05	17.87	.....	.....	.....	.....	.....	.....	.....
1 p. m	11.74	15.43	79	77	72.4	72.1	72.7	71.4	.....
2 p. m	11.44	14.33	.....	.....	.....	.....	.....	.....	.....
3 p. m	6.16	10.39	.....	.....	.....	.....	.....	.....	.....
4 p. m	3.83	6.61	97	90	72.9	72.5	72.7	71.4	.....
5 p. m	1.70	4.35	.....	.....	.....	.....	.....	.....	.....
6 p. m	.....	1.87	.....	.....	.....	.....	.....	.....	.....
7 p. m	.....	.....	95	87	72.7	72.5	72.8	71.4	.....
8 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
9 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
10 p. m	.....	.....	83	69	72.3	.....	72.8	71.4	.....
11 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
Midnight	.....	.....	.....	.....	.....	.....	.....	.....	.....
Mean	.....	.....	75	74	72.1	72.2	72.7	71.4	70.7
Total	162.62	168.83	.....	.....	.....	.....	.....	.....	.....

TABLE 3.—*Rainfall at stations in Costa Rica, May, 1904.*

Stations.	Height above sea level.	Observed, 1904.		Averages.		
		Amount.	Number of days.	Number of years.	Amount.	Number of days.
	Feet.	*Inches.*			*Inches.*	
Sipurio (Talamanca)	197	.....	.....	4	7.87	30
Boca Banano	10	4.07	13	8	7.40	17
Port Limon	10	.....	.....	10	11.34	13
Swamp Mouth	10	.....	.....	6	5.39	14
Zent	66	5.24	12	3	4.88	10
Siquirres	197	.....	.....	6	11.22	16
Dos Novillos	400	.....	.....	.....	.....	.....
Guapiles	984	.....	.....	4	10.71	14
Cariblanco (Sarapiquí)	2,740	.....	.....	6	19.41	23
San Carlos	528	7.06	26	6	11.38	18
Las Lomas	873	.....	.....	4	11.34	13
Peralta	1,089	.....	.....	6	13.94	19
Turrialba	2,034	.....	.....	9	7.09	17
Juan Viñas	3,412	.....	.....	8	5.87	11
Santiago	3,609	.....	.....	3	6.30	15
Paraiso	4,383	.....	.....	3	14.65	19
Cachí	3,346	.....	.....	3	8.66	19
Las Concavas	4,386	9.34	25	3	10.16	23
Cartago	4,761	.....	.....	3	11.69	13
Tres Rios	4,265	21.70	28	15	12.83	16
San Francisco Guadalupe	3,894	.....	.....	8	8.58	18
San José	3,806	9.22	27	15	8.86	19
La Verbena	3,740	14.58	27	8	8.94	17
Nuestro Amo	2,595	16.06	23	8	10.83	17
Alajuela	3,117	9.30	23	4	16.97	20
San Isidro Alajuela	4,416	31.14	30	3	19.61	24
Las Cañas	2,559	23.56	29	.....	.....	.....
Puntarenas	.....	8.19	16	.....	.....	.....

Notes on earthquakes.—May 5, 9h 30m a. m., very slight shock NNW.–SSE., duration 3 seconds, intensity I.

CLIMATOLOGICAL DATA FOR JAMAICA.

Through the kindness of Mr. H. H. Cousins, chemist to the government of Jamaica and now in charge of the meteorological service of that island, we have received the following table in advance of the regular monthly weather report for Jamaica:

Comparative table of rainfall for May, 1904.

[Based upon the average stations only.]

Divisions.	Relative area.	Number of stations.	Rainfall.	
			1904.	Average.
	Per cent.		*Inches.*	*Inches.*
Northeastern division	25	26	6.91	11.36
Northern division	22	43	7.33	7.30
West-central division	26	24	9.55	12.05
Southern division	27	37	6.26	7.40
Means	100	134	7.51	9.53

The rainfall for May was, therefore, very much below the average for the whole island; the greatest fall, 18.84 inches, occurred at Brownsville, in the west-central division, while 0.83 inch was recorded at Bybrook in the northeastern division.

Chart I. Tracks of Centers of High Areas. May, 1904.

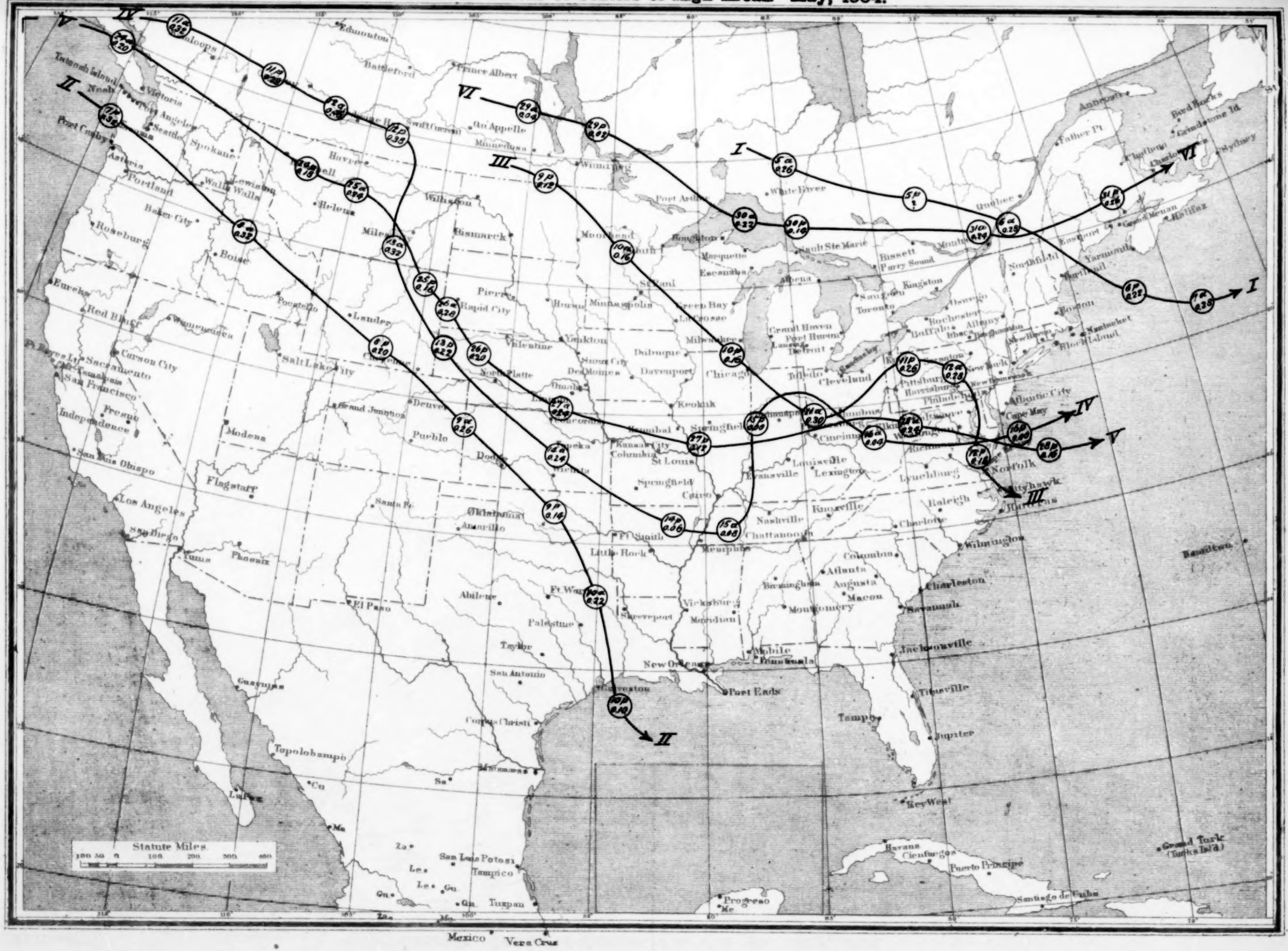


Chart II. Tracks of Centers of Low Areas. May, 1904.

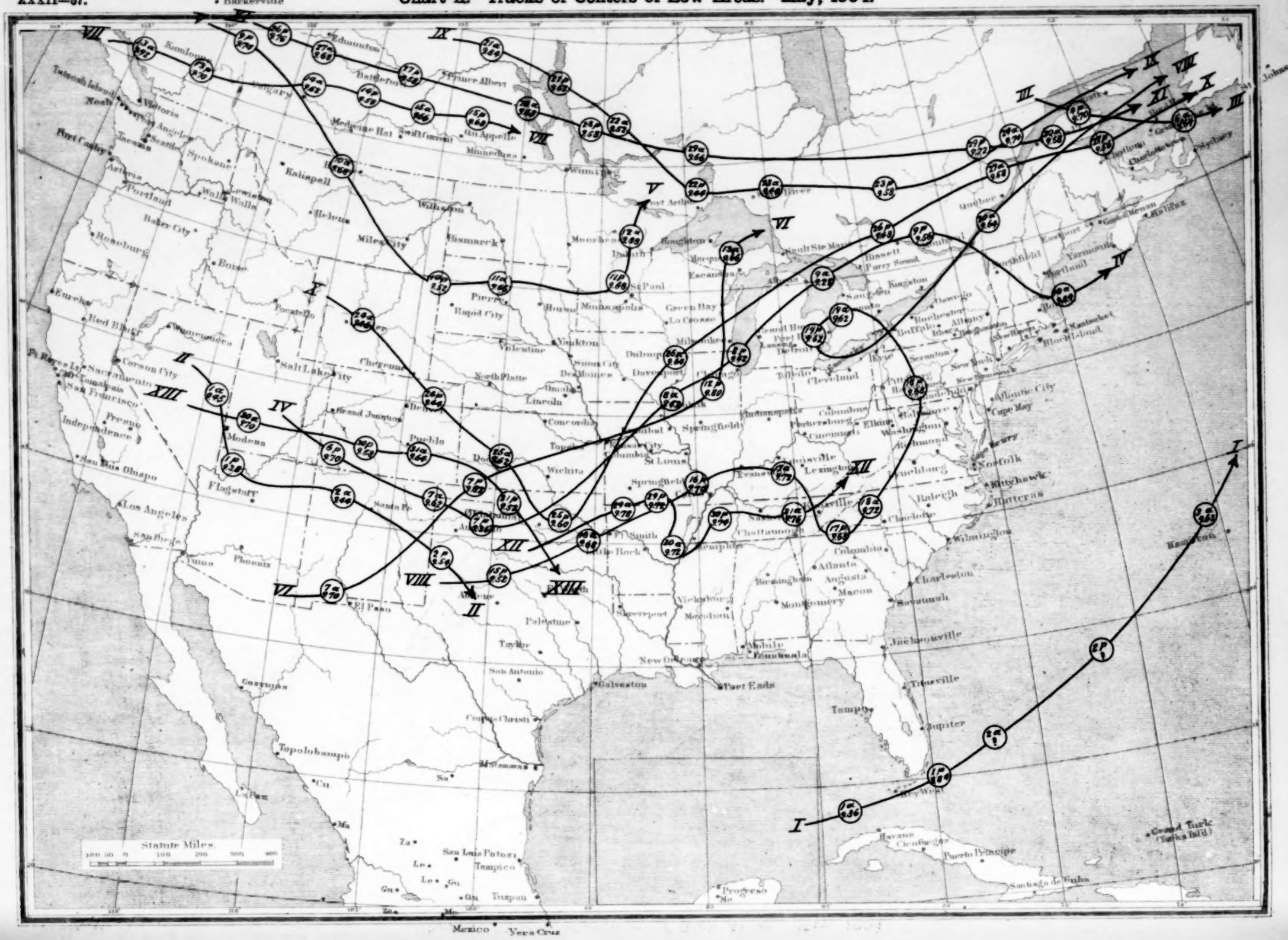
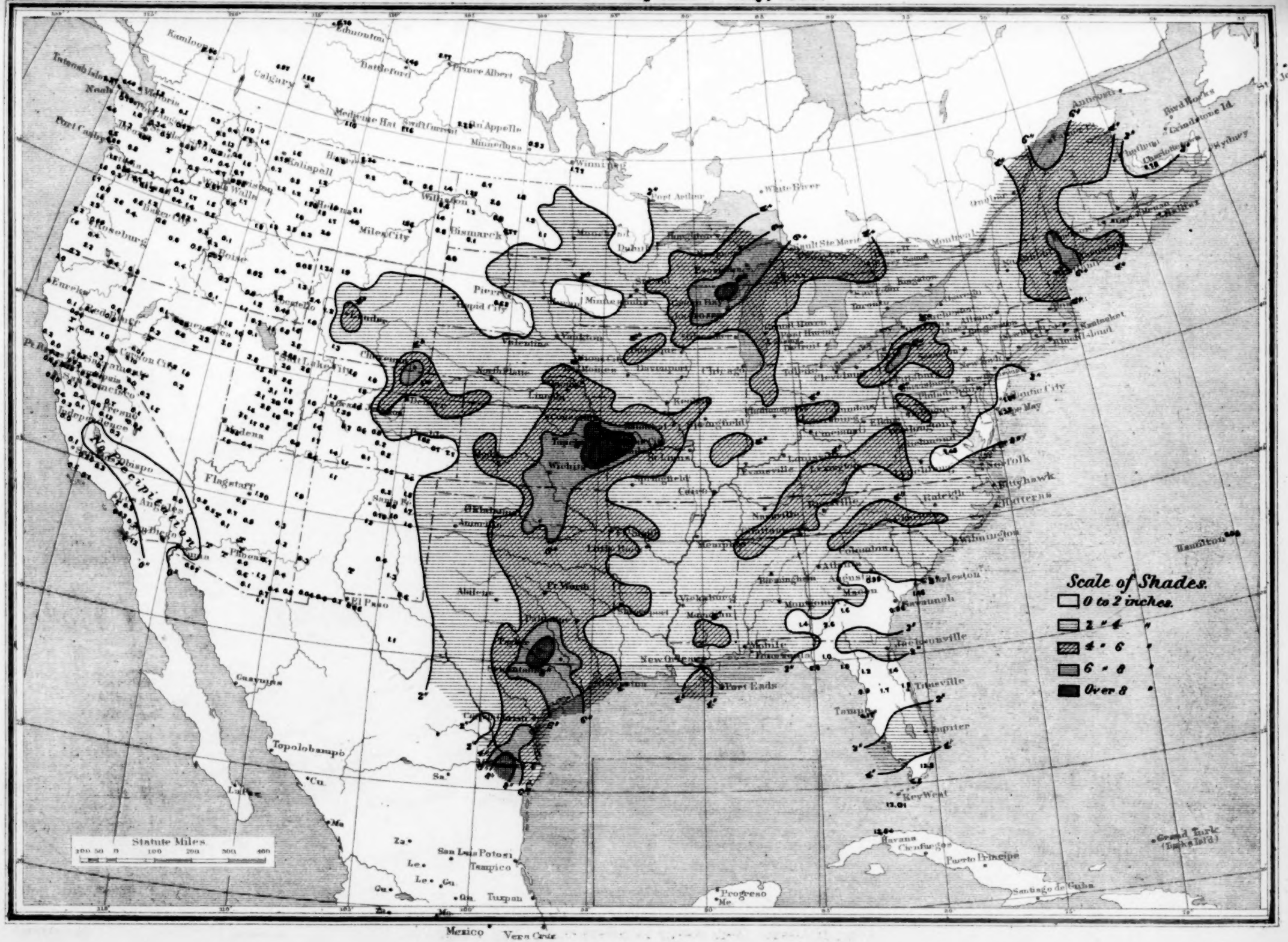
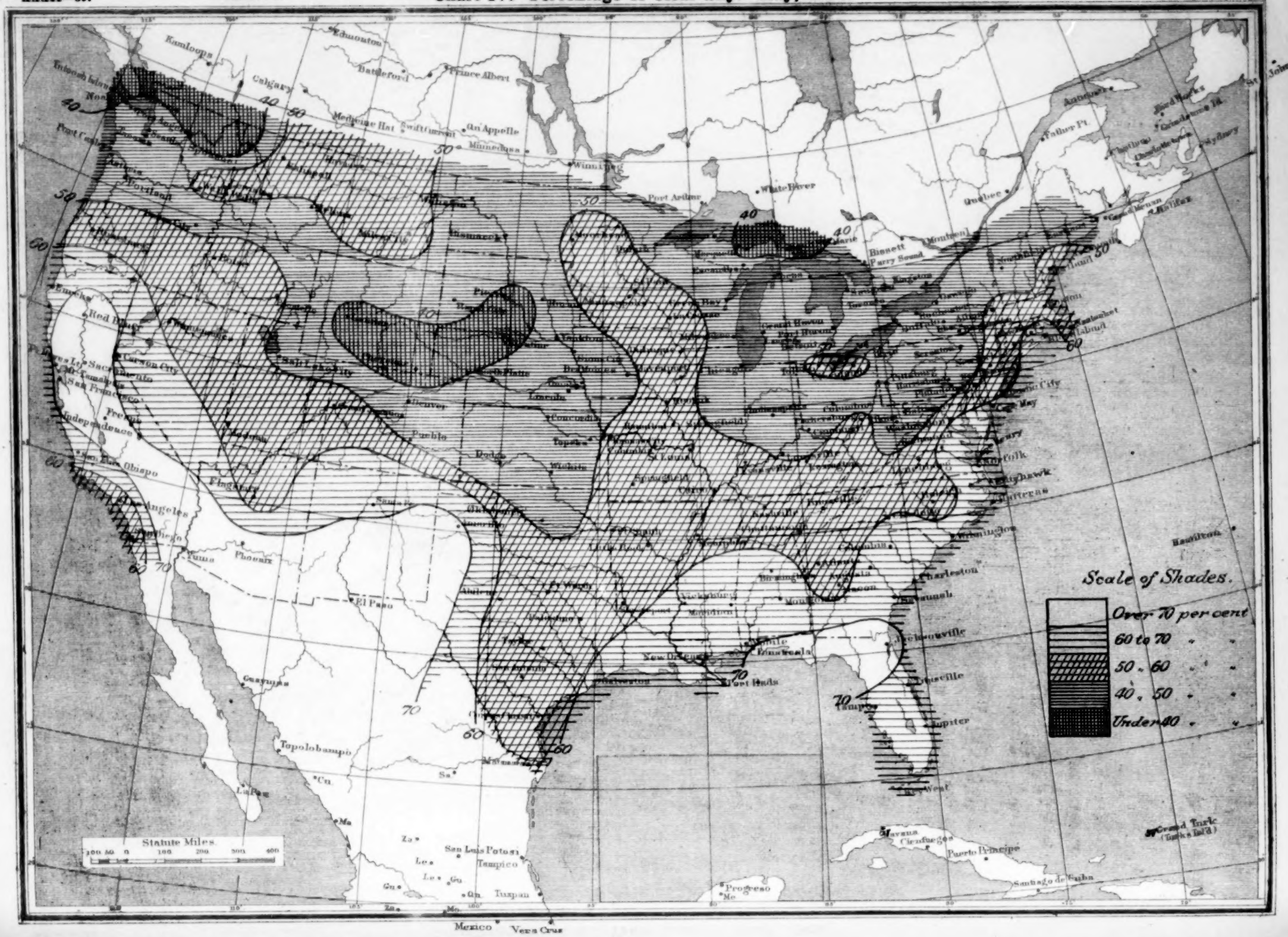


Chart III. Total Precipitation. May, 1904.



• Barkerville

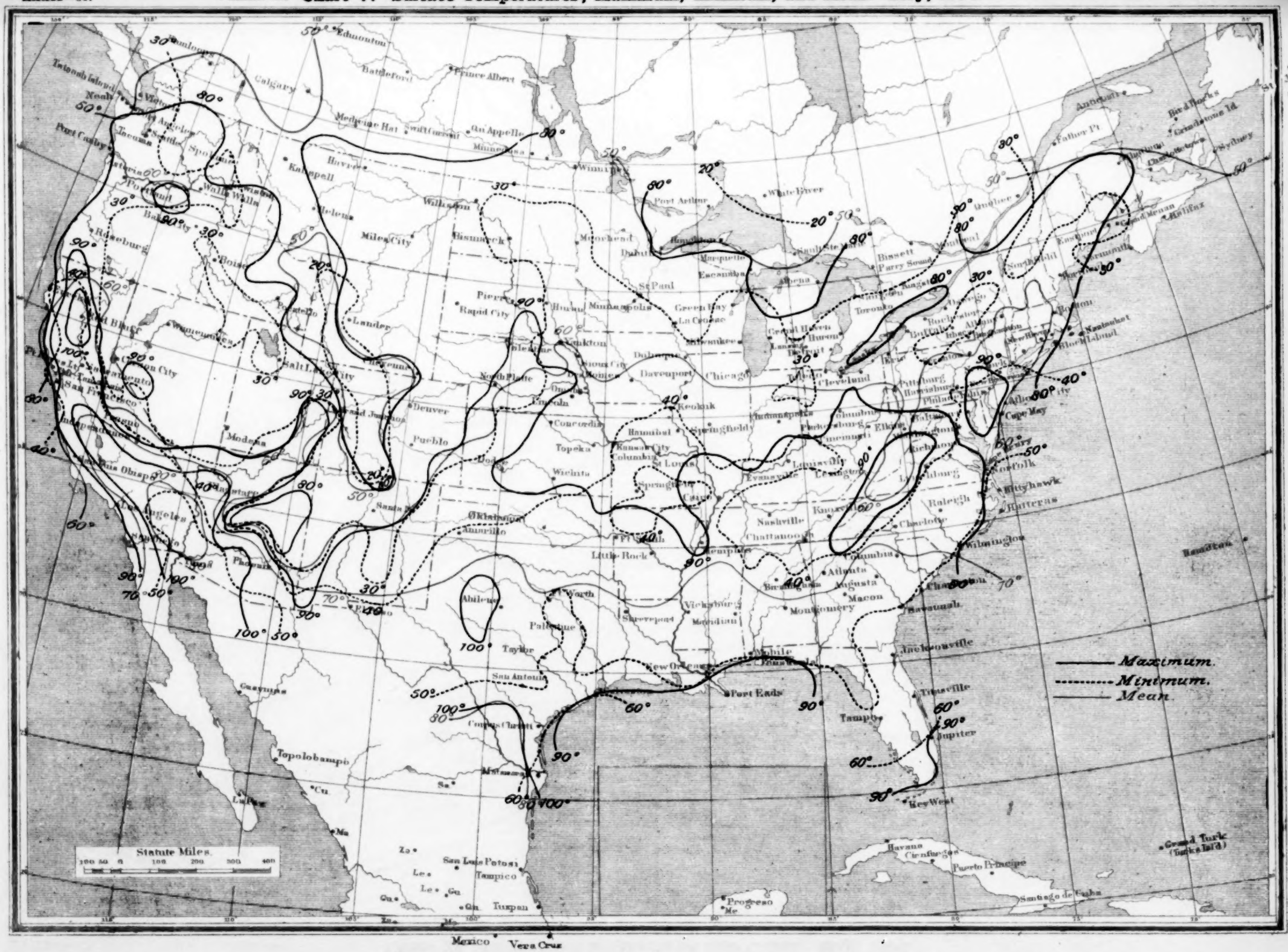
Chart IV. Percentage of Clear Sky. May, 1904.



• Barkerville

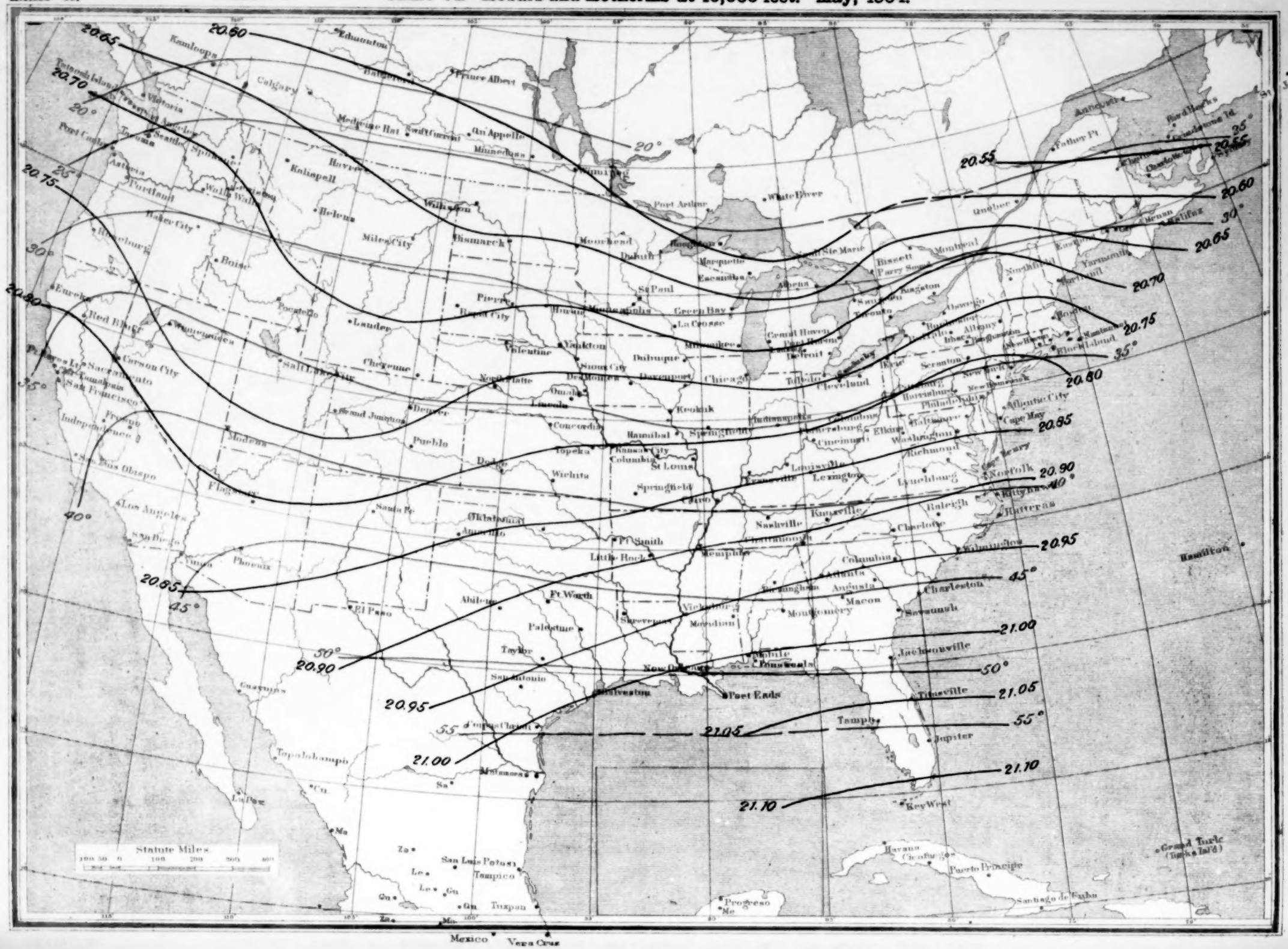
Chart V. Surface Temperatures: Maximum, Minimum, and Mean. May, 1904.

• Barkerville **Chart V. Surface Temperatures; Maximum, Minimum, and Mean. May, 1904.**



XXXII—61. • Baskerville

Chart VI. Isobars and Isotherms at 10,000 feet. May, 1904.



XXXII—62. • Baskerville

Chart VII. Isobars and Isotherms at 3500 feet. May, 1904.

Chart VII. Isobars and Isotherms at 3500 feet. May, 1904.

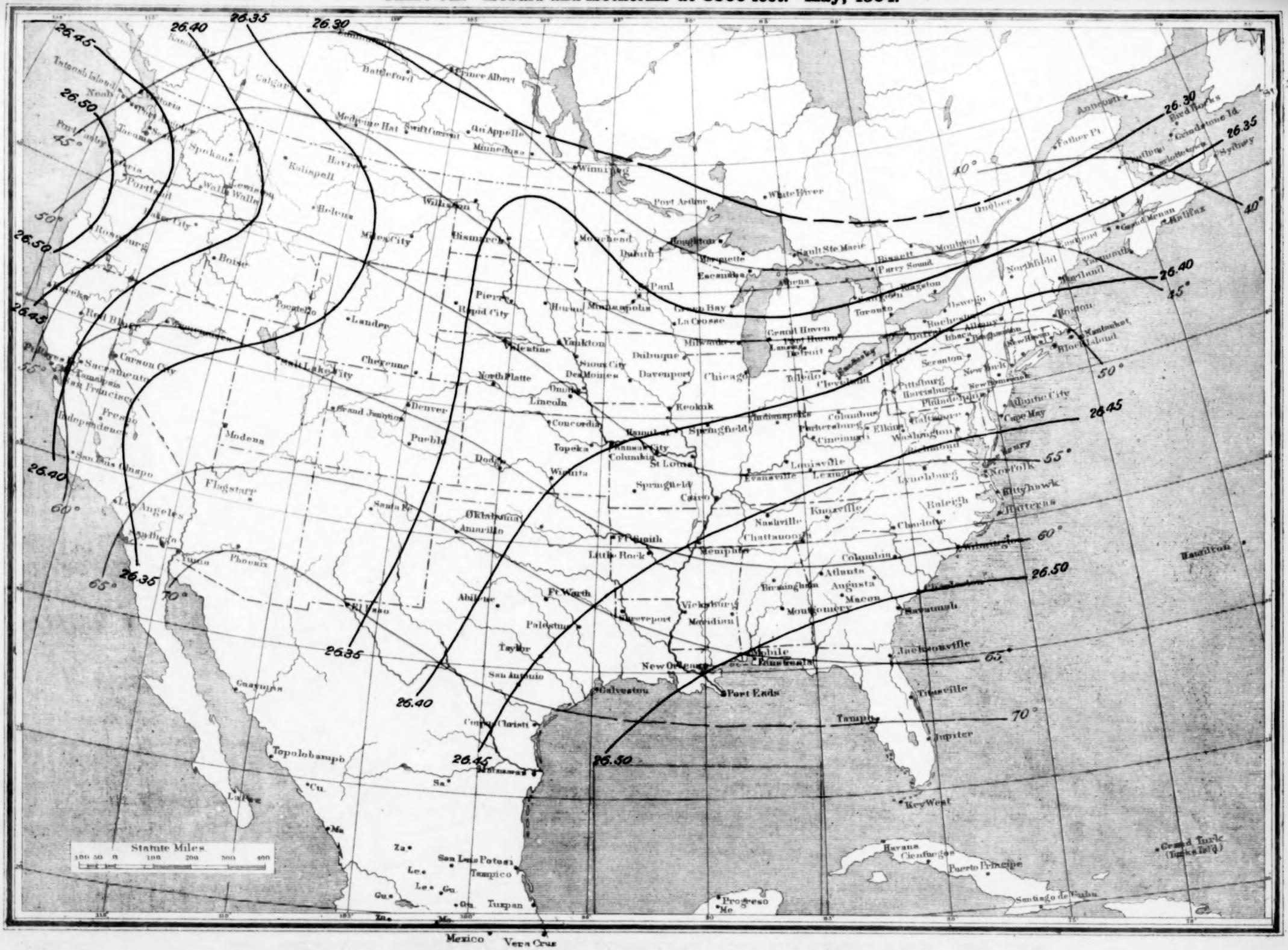


Chart VIII. Isobars and Isotherms at Sea Level; Resultant Surface Winds. May, 1904.

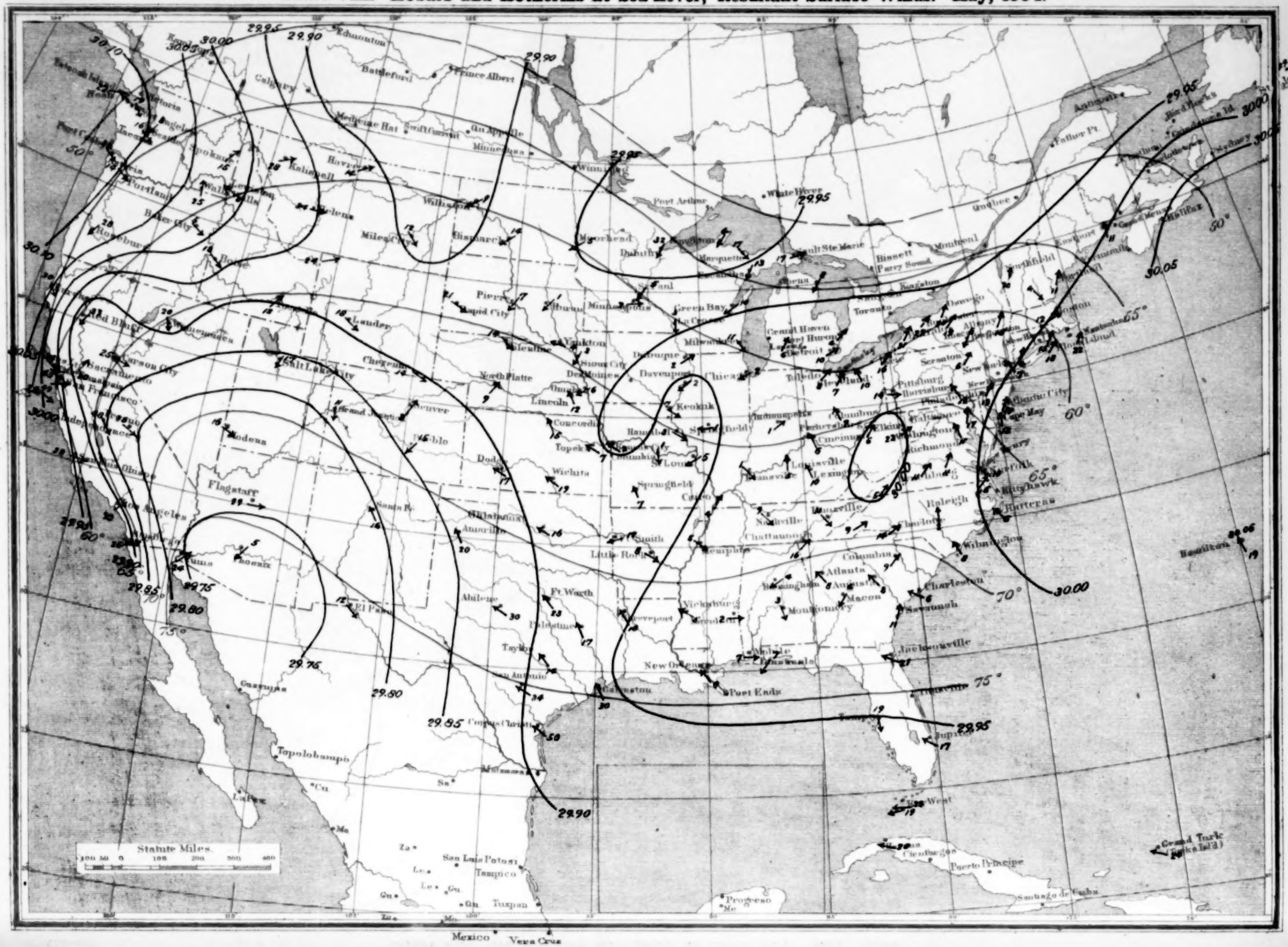


Chart IX. Sea-Level Isobars, Surface Temperatures, and Resultant Winds. May, 1904.

Mexico Vera Cruz

XXXII—64.

Chart IX. Sea-Level Isobars, Surface Temperatures, and Resultant Winds. May, 1904.

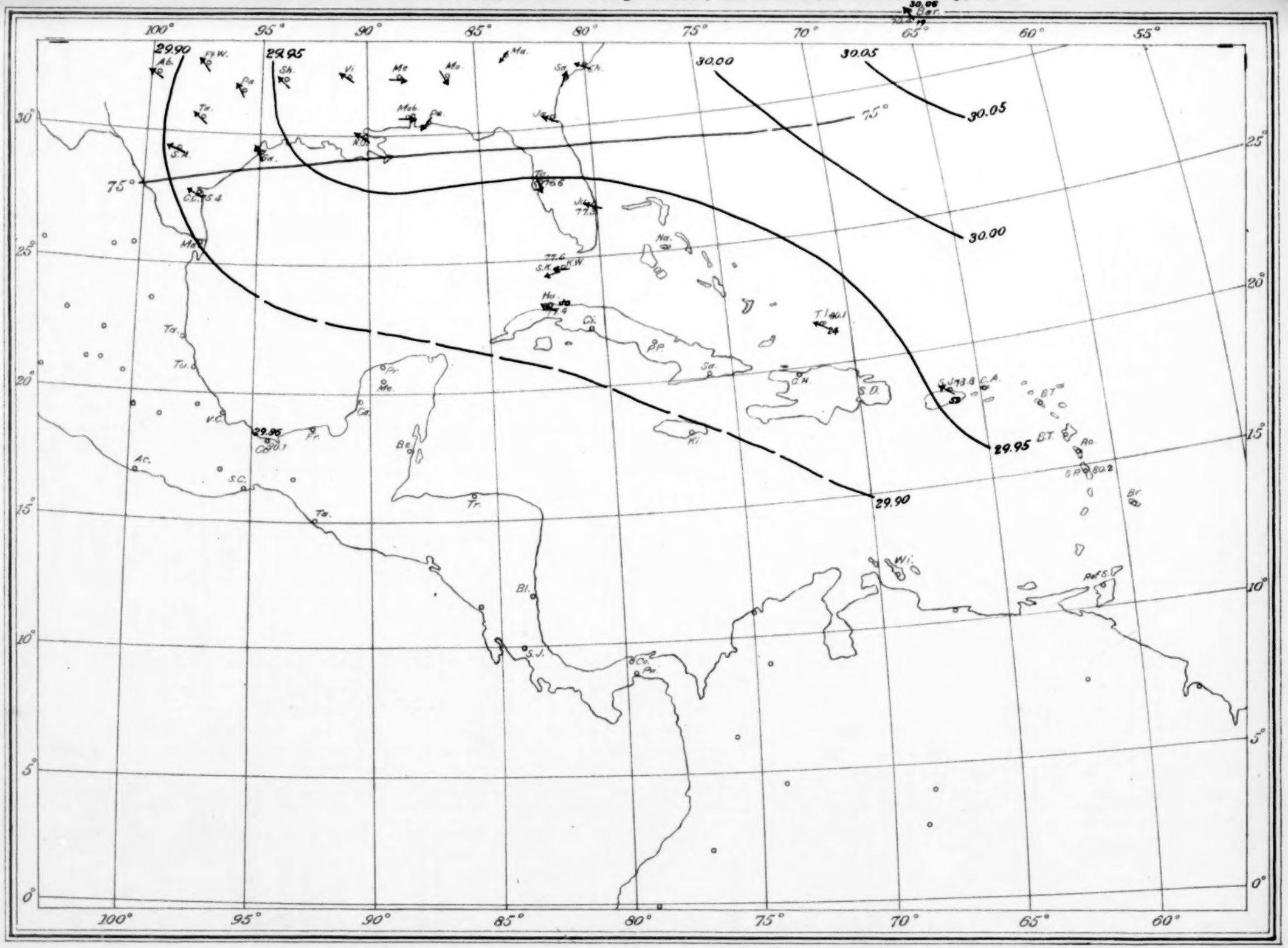


Chart X. Hydrographs for Seven Principal Rivers of the United States. May, 1904.

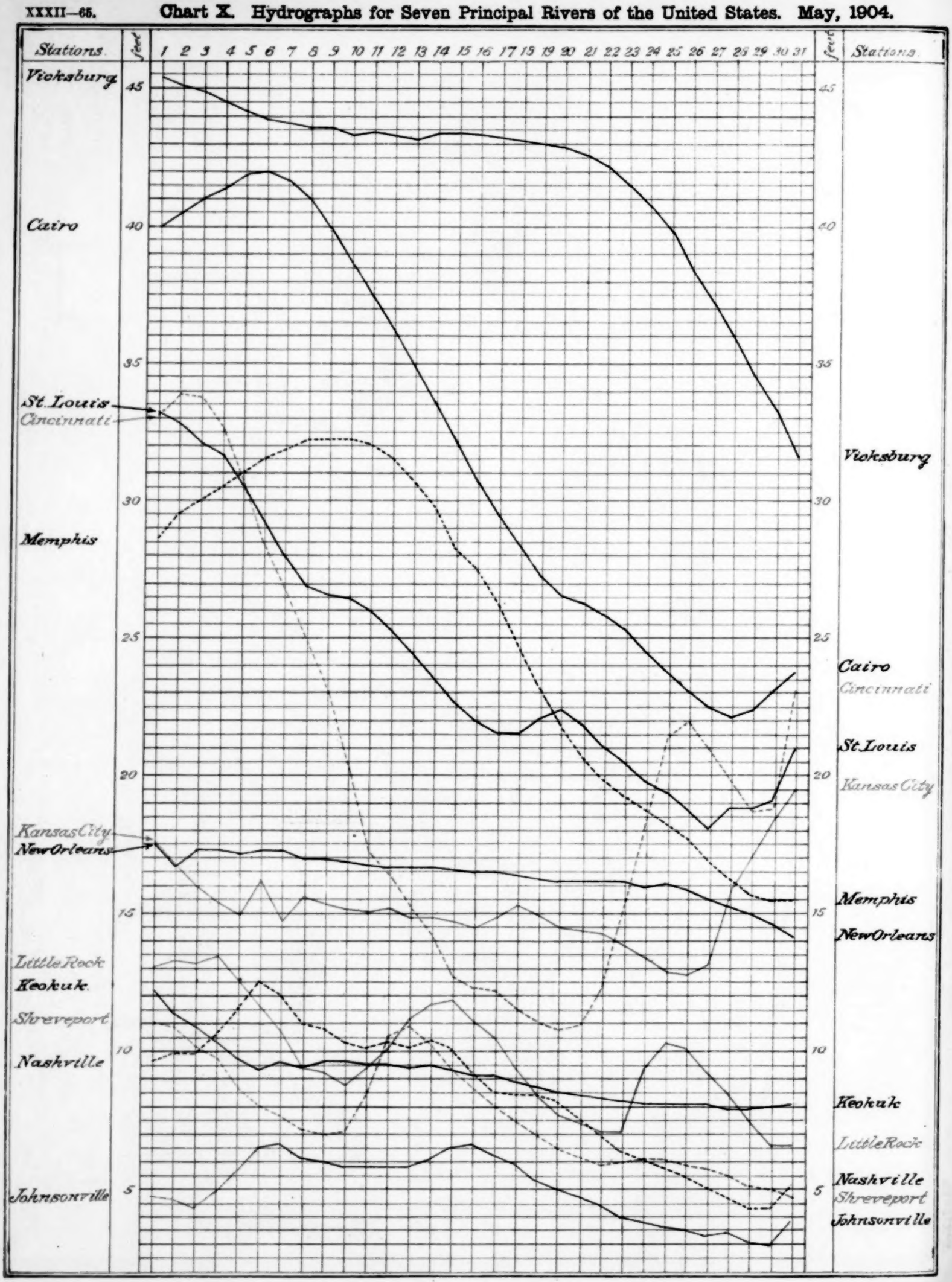


Chart XI. Total Snowfall, May, 1904.

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Chart XI. Total Snowfall. May, 1904.

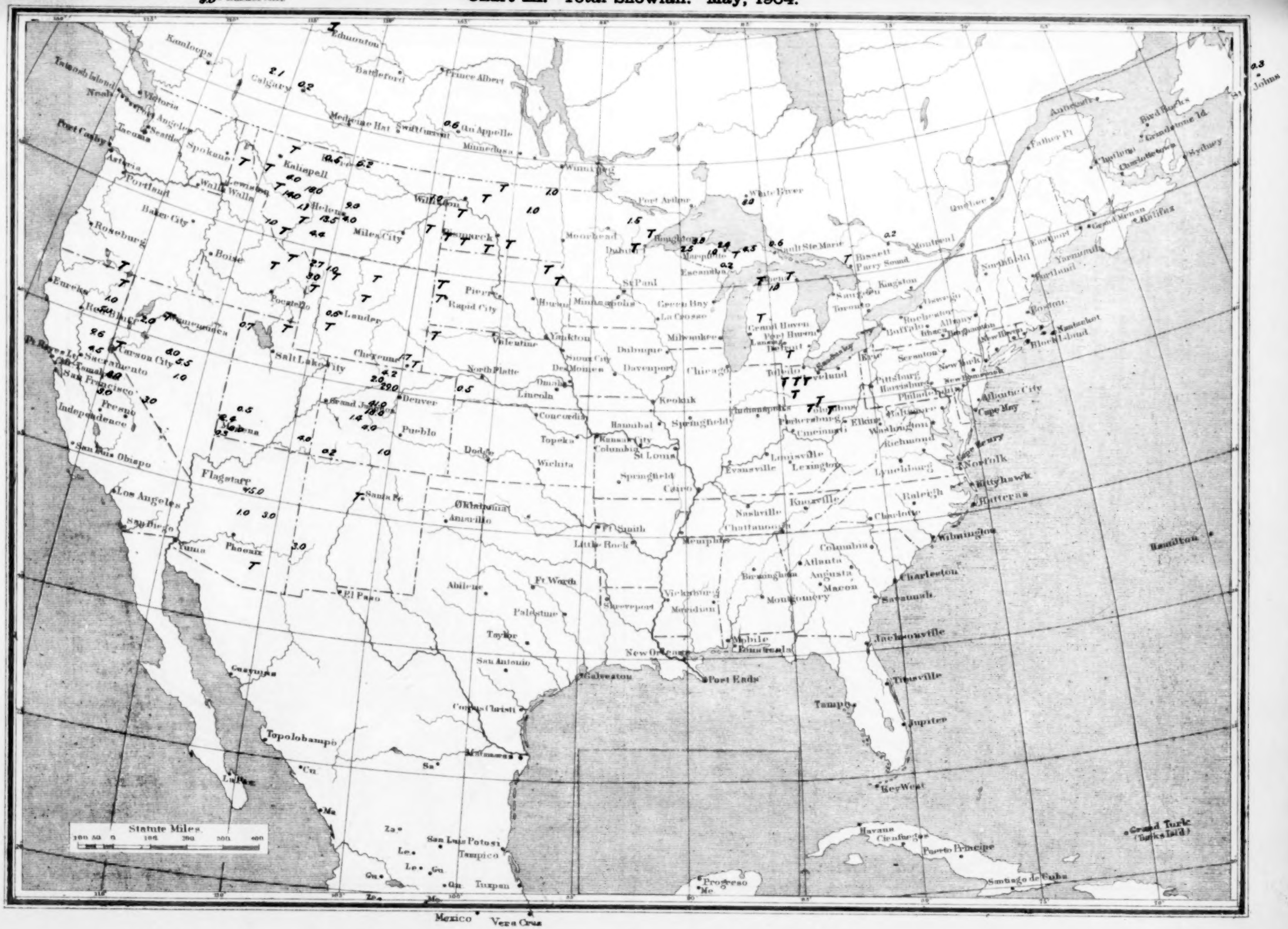

Chart XII. Isobars on the sea level, the 3500-foot, and the 10,000-foot planes.

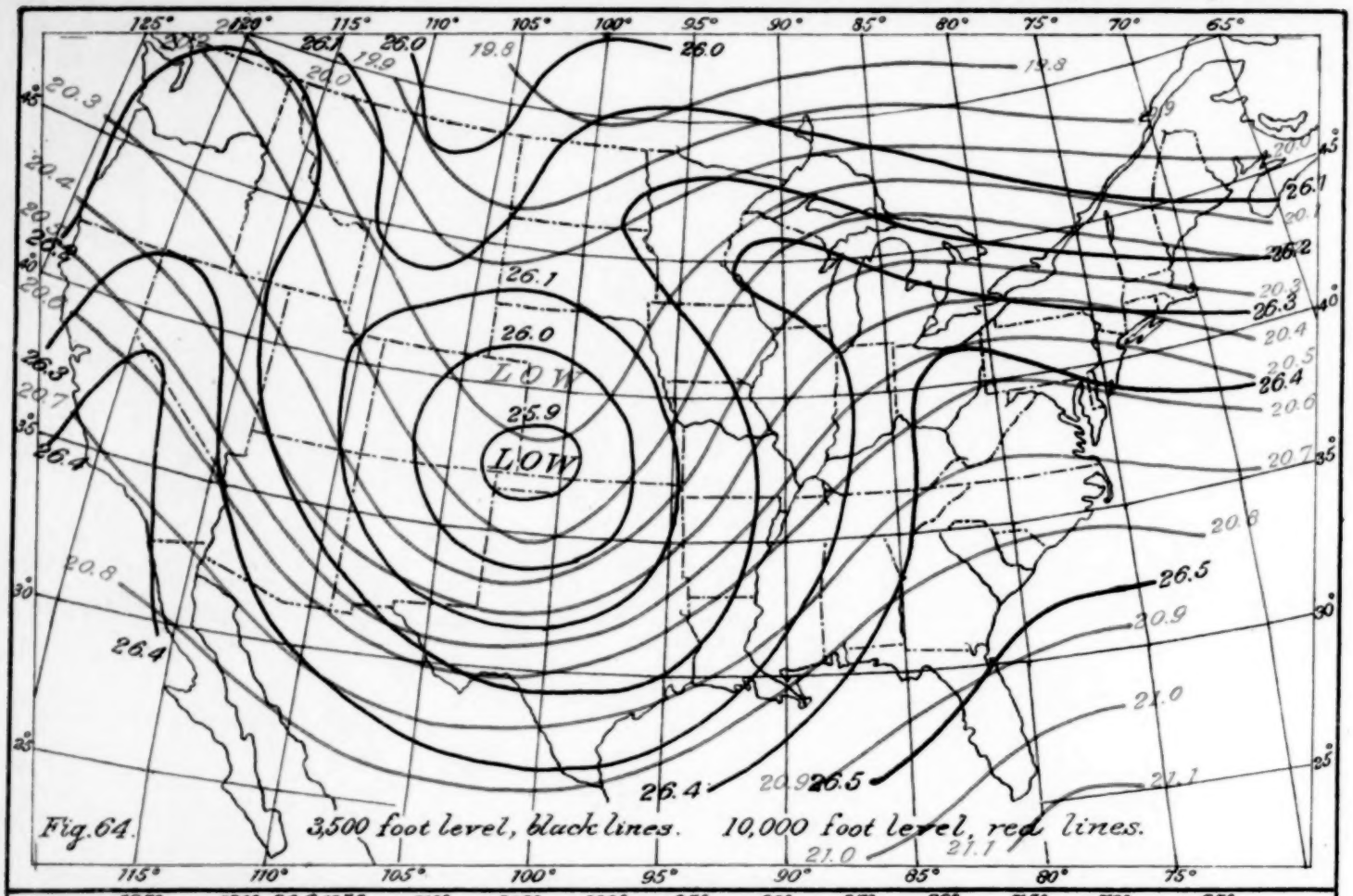

Fig. 64. 3,500 foot level, black lines. 10,000 foot level, red lines.

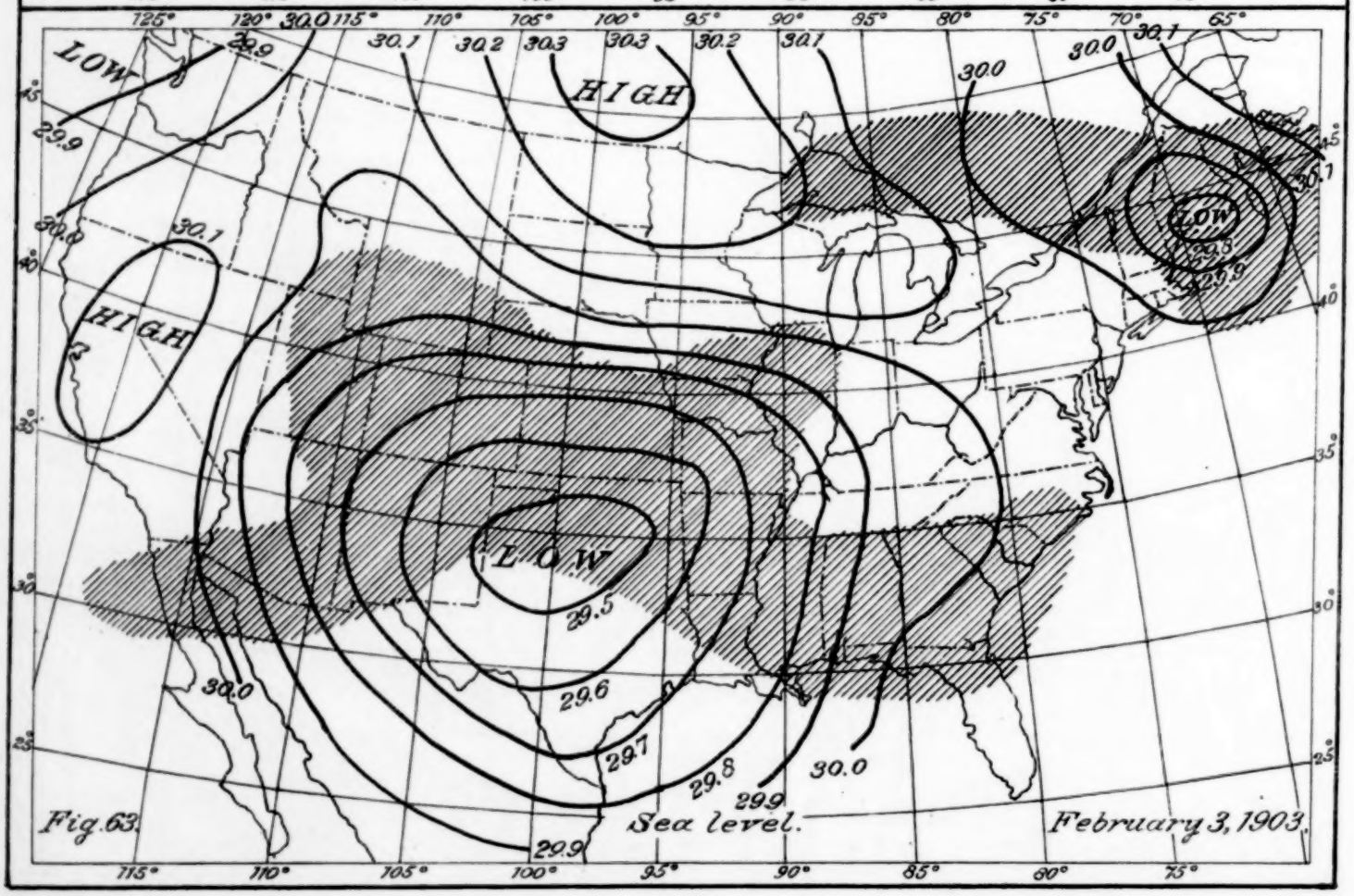

Fig. 63. Sea level. February 3, 1903.

Chart XIII. Components of pressure on the 3500-foot and the 10,000-foot planes.

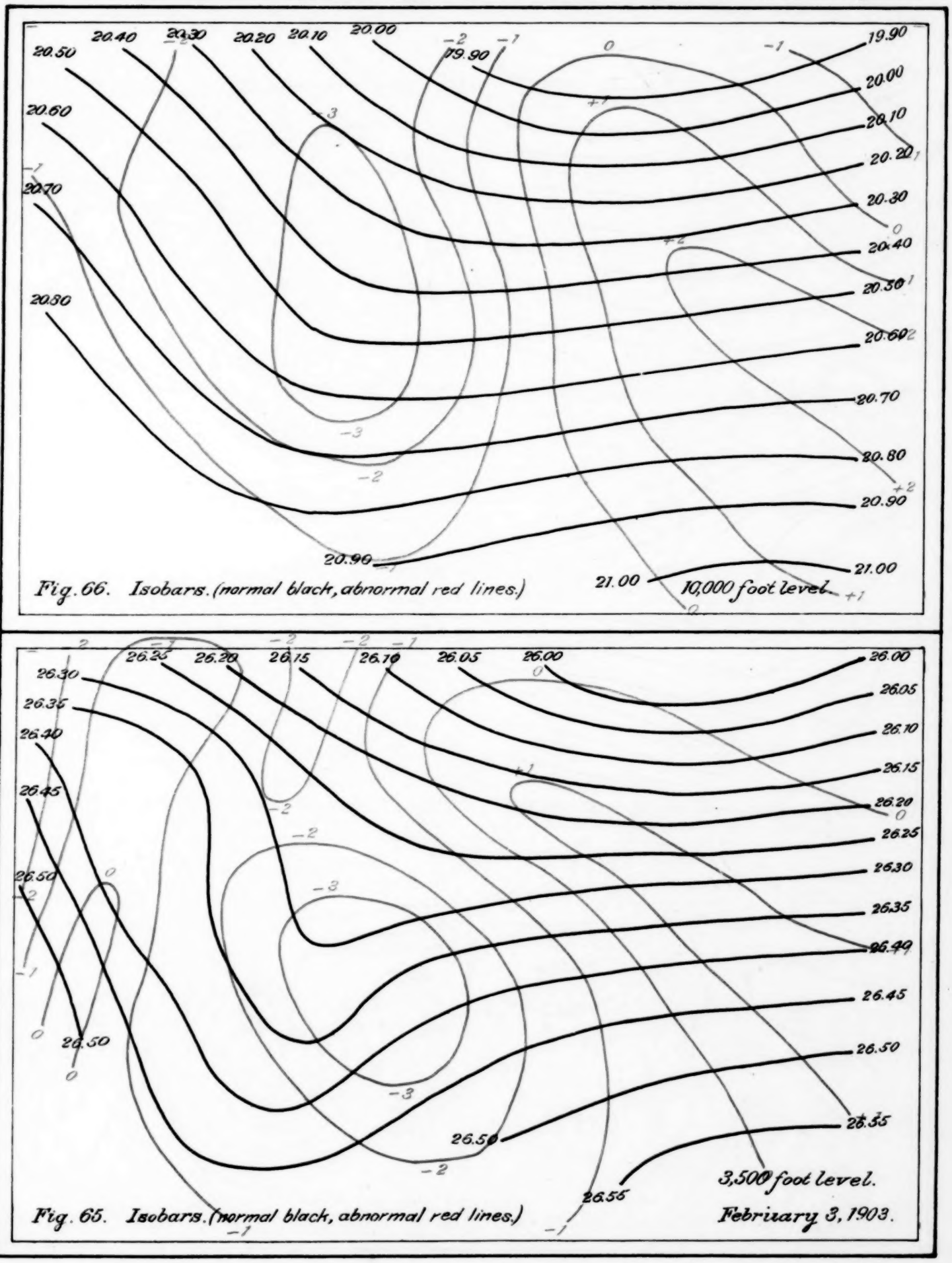

Fig. 66. Isobars. (normal black, abnormal red lines.)

Fig. 65. Isobars. (normal black, abnormal red lines.)

Chart XIV.—Typical distribution of normal and abnormal isobars.

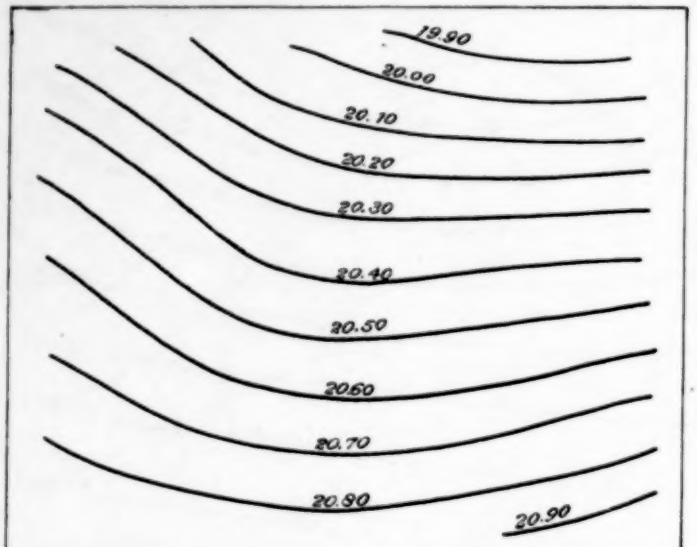

Fig. 69. Typical normal Isobars. (10,000 foot).

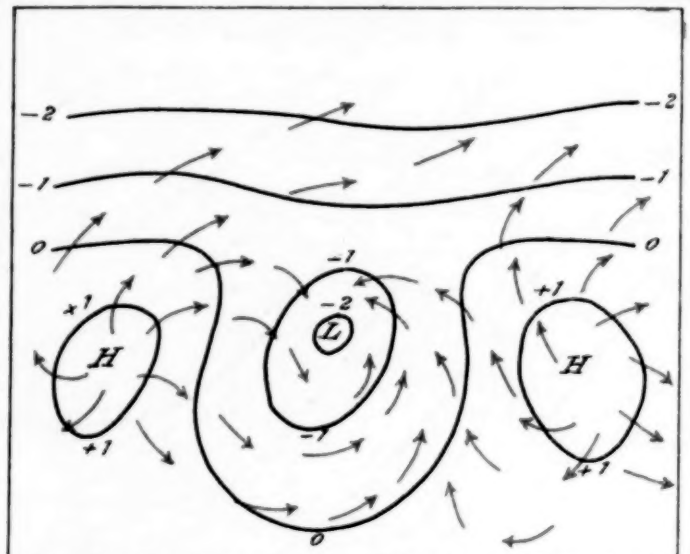

Fig. 72. Typical abnormal Isobars. (10,000 foot).

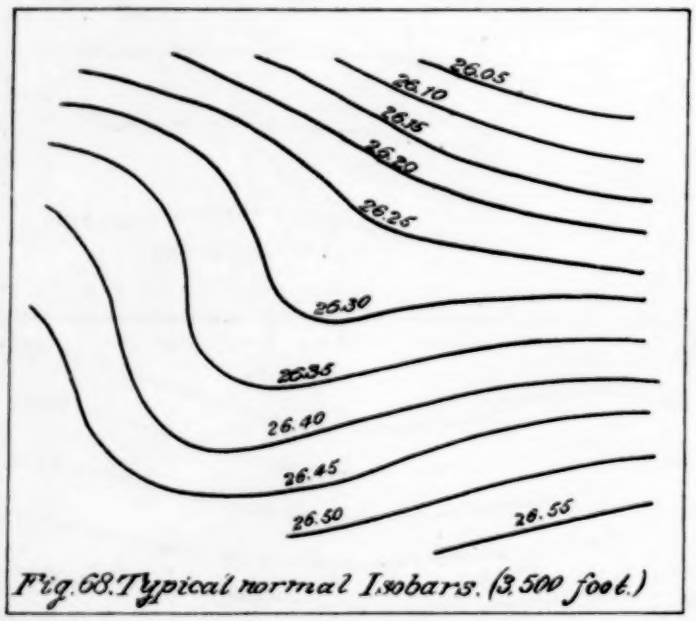

Fig. 68. Typical normal Isobars. (3,500 foot.)

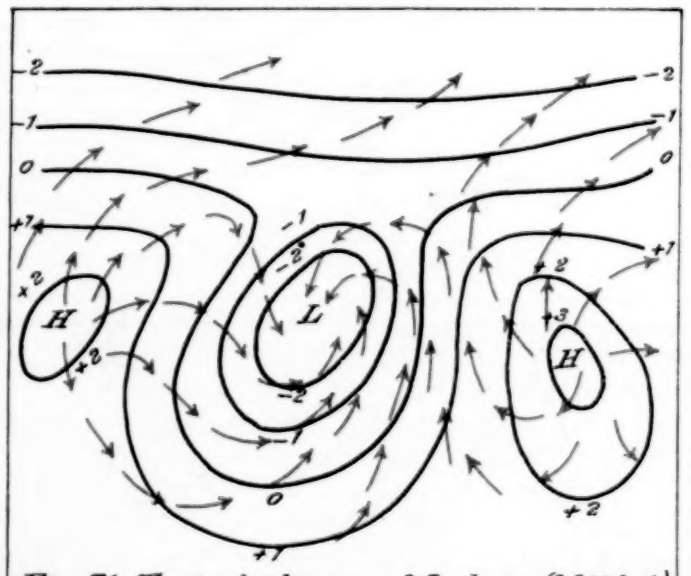

Fig. 71. Typical abnormal Isobars. (3,500 foot.)

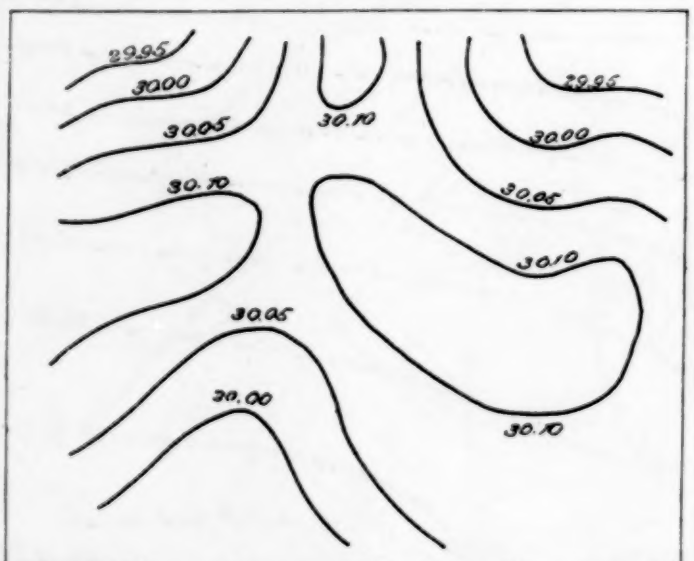

Fig. 67. Typical normal Isobars. (Sea level.)

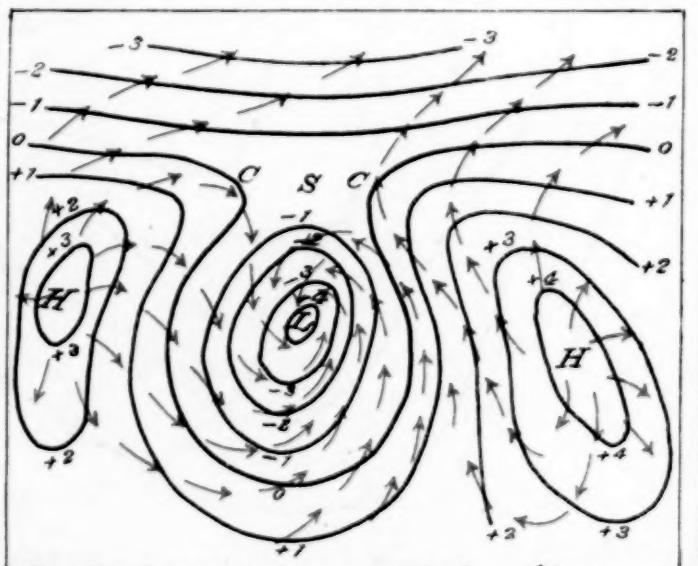

Fig. 70. Typical abnormal Isobars. (Sea level).

Chart XV. Typical normal and abnormal isotherms showing the positions of the maximum excess and deficiency of heat.

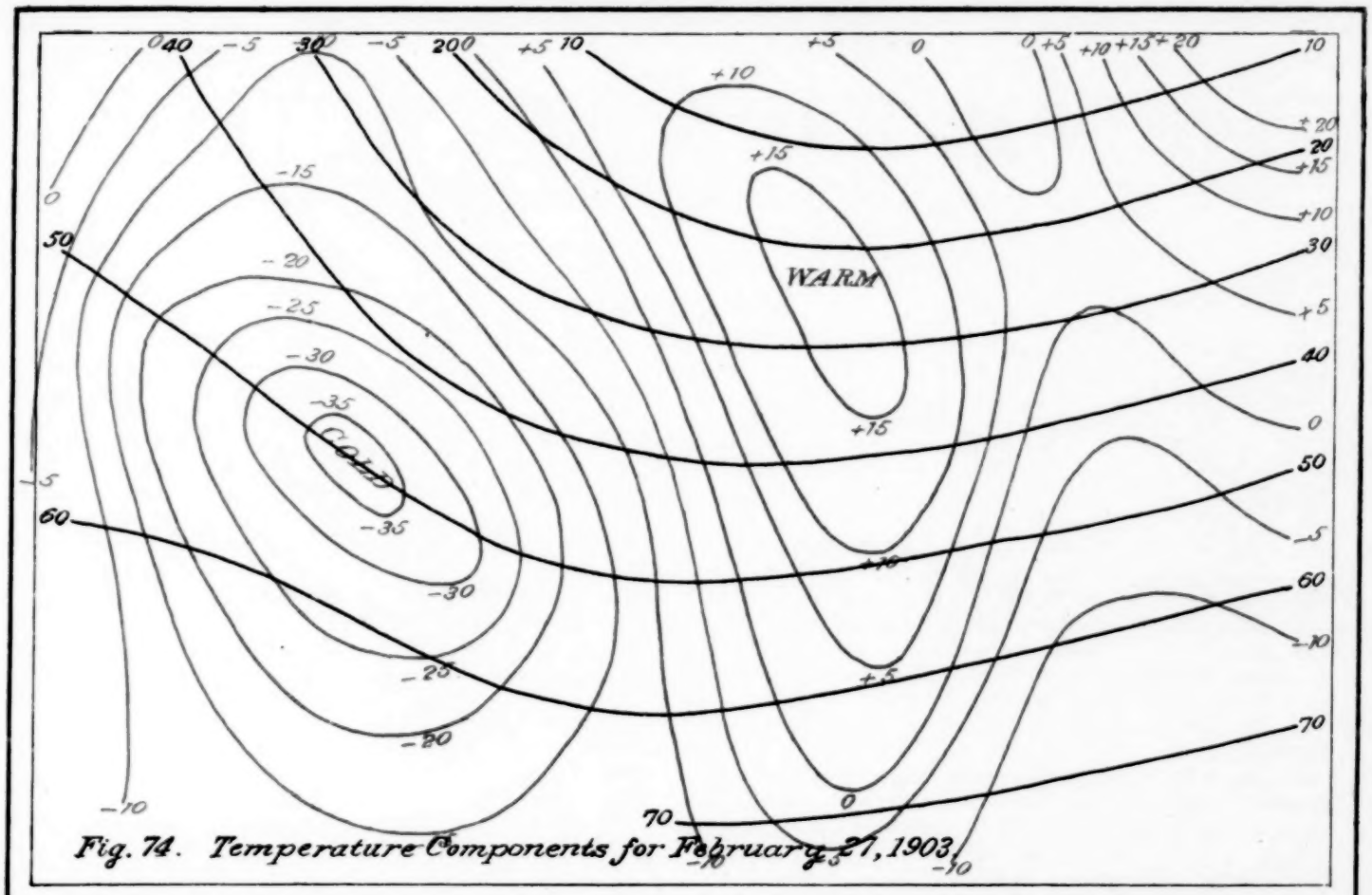

Fig. 74. Temperature Components for February 27, 1903.

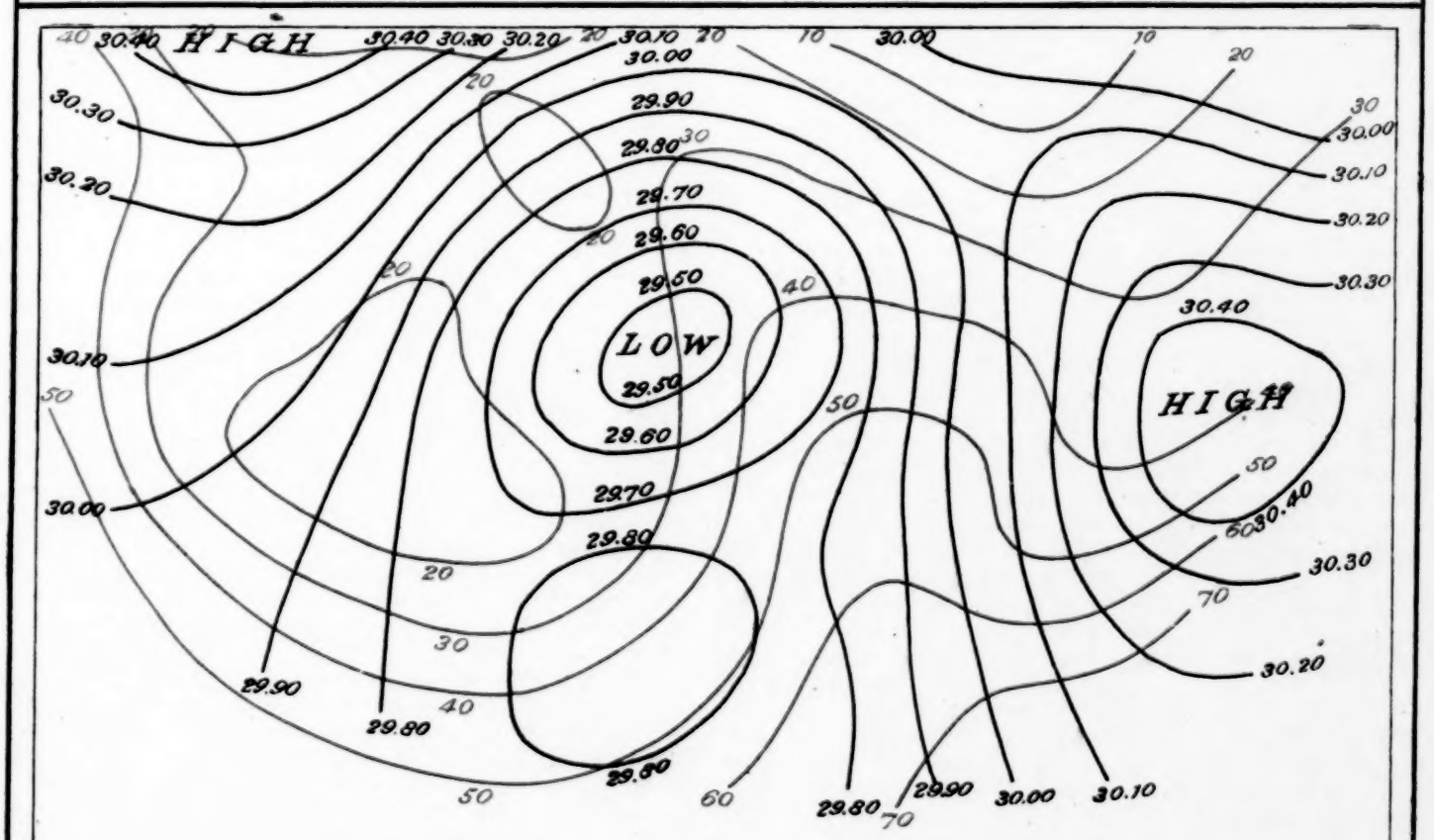

Fig. 73. Isobars and Isotherms on the Weather Map for February 27, 1903.